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THE APPLICATION OF RECENT CONTRIBUTIONS IN BASIC MEDICAL SCIENCES TO SURGICAL PRACTICE

THE PERIPHERAL CIRCULATION INCLUDING THE LYMPHATICS

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BLOOD

DURING recent years, there has been an increasing interest in the circulation of the skin and extremities. Such studies are of physiological as well as of clinical importance, since they provide an insight into the behavior of the peripheral vessels under a variety of normal and abnormal conditions and point the way to the more rational management of peripheral vascular diseases.

The methods employed in the study of the peripheral circulation have recently been reviewed (1, 2, 3). Burton (1) describes three general methods for the study of peripheral blood flow. Direct microscopic observation of the capillaries is limited in the human being to the vessels of the nail bed. The technique developed by the Clarks (4) for the direct observation of the vessels in the rabbit's ear has recently been employed by Seldon and Lundy (5) to study the effect of various anesthetic agents on the peripheral vessels. This method should find wide application.

The second general method involves the recording of volume changes or volume pulsations in the vessels of the skin and extremities. In the simple plethysmograph, changes in the volume of the part which is enclosed in a suitable container are recorded. Such changes in volume are assumed to be due solely to changes in the blood content of the part. The method is obviously limited to skin areas which can be enclosed in an appropriate container. Various recording systems have been used, the older mechanical piston recorders having been replaced more recently by water or air transmission recorders such as described by Goetz (3) and Johnson (6), or by optical methods such as recently described by Wright and Phelps (7). The fact that the absorption of light by a transilluminated tissue varies with its blood content has recently been employed to detect vascular changes with the photo-electric cell. Numerous such photo-electric plethysmographs have recently been described (3, 8, 9, 10, 11, 12). Hertzman (8) discusses the method in detail and points out various sources of error which must be avoided. One of these sources of error is the influence of the ratio of reduced hemoglobin to oxyhemoglobin on skin opacity. To obviate this difficulty, Gross, Matthes, and Goepfert (11) employ two photocells simultaneously. One, recording in the ultrared, represents a pure plethysmogram of the blood content because in this region of the spectrum, reduced hemoglobin and oxyhemoglobin transmit the same amount of light. The other cell, recording in the visible red region, represents changes in oxygen saturation because in this region reduced blood transmits much less light than oxygenated blood. The advantage of the photo-electric method is the fact that it can be applied to a wide variety of skin areas and does not require enclosure of the part in a container.

The question arises as to the interpretation of plethysmographic records of this type in terms of

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vascular reactions. The first type of record which is obtained by such plethysmographs is the so-called volume pulse. This represents the difference between arterial inflow and venous outflow during a single cardiac cycle. Provided cardiac output and blood pressure remain constant the magnitude of the volume pulse apparently depends upon the tone of the small arteries and arterioles and hence is a measure of arteriolar tone (3, 8, 13). The volume pulse has also been used as an index of vascular tone by Burton (14, 15). According to Goetz (3) and to Hertzman (8), capillary and venous pulsations probably do not contribute to the volume pulse, although the latter author does not entirely eliminate this possibility. Burton (1), however, states that the pulsation in the skin originates mainly in the capillaries. This has a bearing on the interpretation of the volume pulse in terms of blood flow. Since blood flow is determined chiefly by the state of the small arteries and arterioles, the volume pulse should give an indication of blood flow if it also depends chiefly on arteriolar tone. That such is the case under certain conditions is indicated by Burton (1, 14). However, he points out (1) that variations in venous and capillary pressure may greatly alter the volume pulse without appreciably affecting the flow, and that therefore the volume pulse cannot always be taken as an indication of the volume flow. Hertzman (8) regarded the volume pulse as an indicator of arterial flow. Later, Hertzman and Dillon (13) used the volume pulse as a direct measure of arterial tone and the product of volume pulse amplitude and heart rate as an indicator of flow in an attempt to analyze arterial, venous, and flow components in photo-electric plethysmography.

In addition to volume pulse records, such plethysmograms also record changes in the total volume. The latter depends upon the blood content of the capillaries and veins (1, 3). Since changes in total volume may be the result of changes in arterial inflow, venous outflow, or both, one cannot interpret every volume increase as representing an increased arterial flow, or vice versa. Ferris and Abramson (2) observed, for example, a decrease in forearm volume associated with an increased blood flow. Total volume changes used in conjunction with the volume pulse may help distinguish between arterial and venous components in photo-electric plethysmography (13). Further studies on vascular reactions in terms of "active" and "passive" arteriolar and venous components will be cited later.

The third method available for the study of the peripheral circulation is the actual determination of flow by means of various modifications of the venous-occlusion plethysmograph first introduced by Hewlett and van Zwaluwenburg in 1909–1910 (16). The method is based on the fact that if venous outflow is suddenly stopped, the initial rate of limb swelling represents the arterial inflow at the moment of occlusion. Details of the method, sources of error, and improved apparatus have recently been discussed by several authors (1, 2, 7, 17, 18, 19). This method allows arterial inflow to be expressed in cubic centimeters per minute.

Since the total blood flow to an extremity represents the summation of the flow to the individual tissues, i.e., skin, muscle, and bone, it is necessary to evaluate plethysmographic records in terms of these component tissues. In the fingers, there is no muscle and about 50 per cent skin (2). Assuming that the flow to the bone and tendon is negligible, practically all of the blood flow to the fingers represents cutaneous flow. Interpretation of the site of vascular reactions in the forearm is somewhat more difficult. According to Grant and Pearson (20), muscle makes up about 85 per cent and skin about 9 per cent of the forearm volume. Abramson and Ferris (2, 21), however, report that the forearm is made up of 58.6 per cent muscle and 13.4 per cent skin. It is probably safe to assume that vascular changes in the forearm represent chiefly changes in muscle flow (20, 27). The possibility of simultaneous changes in the skin and muscle circulation which may either reinforce or oppose one another, complicates the picture in this region. Moreover, it is probably not safe to use the finger skin reactions as an indication of forearm skin reactions since Hertzman (29, 30) has emphasized the selective vascular pattern in different skin areas. Also, as pointed out by Abramson (21), the skin of the finger tips contains abundant arteriovenous anastomoses which are not present in the forearm.

Considerable evidence has accumulated to indicate that the circulation of the skin and muscle may be independently regulated. For example, Friedlander and associates (22, 23) observed the effects of various procedures which altered the circulation on the temperature of the calf muscles and skin of the leg. The procedures employed to influence the circulation included lumbar paravertebral alcohol injections, spinal anesthesia, the administration of intravenous hypertonic saline solution, physiological saline solution, adrenalin, or typhoid vaccine, and reflex heat dilatation. It was found that in all cases except those in which hypertonic saline solution was administered, changes occurred in the circulation of the skin with

opposite or no changes in the muscle. The increased blood flow in the forearm produced by nicotinic acid is probably due to an increased muscle flow because it can occur without a rise in the forearm skin temperature (2, 24). Similar results are reported after the injection of insulin (2, 25). Epinephrin has been observed to cause a marked vasoconstriction and decreased flow in the fingers and hand (11, 26), whereas it produces an increased flow in the forearm (26). Abramson and associates (27) found that smoking decreased the blood flow to the hand but not to the forearm. Kunkel *et al.* (26) found that local heat produced a much greater increase in flow in the hand and foot than in the forearm and calf, whereas the reverse was true of exercise. It is probable that these differences represent chiefly differences in the response of muscle and skin, although variations in the reactions of the skin in the two areas may partly contribute to these differences (Abramson, 21).

The fact that the circulation of the muscle and of the skin responds differently to stimuli of various sorts has practical therapeutic as well as physiological interest. As pointed out by Friedlander *et al.* (23) one should choose a therapeutic procedure according to whether one desires chiefly an increased skin circulation (as in cutaneous ulcers) or an increased muscle circulation (as in intermittent claudication). Since sympathetic paralysis fails to increase muscle circulation, ganglionectomy in intermittent claudication has no physiological basis (22, 23). Similarly, local heat is a very effective means of increasing the cutaneous circulation but has little effect on muscle circulation; the reverse is true of exercise (26). Intravenous hypertonic saline solution increases the blood flow in both skin and muscle (23).

Burton (1, 14, 15) has studied the cutaneous circulation in the human fingers, recording volume pulse and flow with a modified venous occlusion plethysmograph. He found a very large range in the normal flow values. The minimum value of flow in maintained vasoconstriction was 0.5 c.cm./min./100 c.cm. of finger volume. This minimal value corresponded to that calculated from the basal oxygen requirements of the skin. In vasodilatation, however, values of over 100 c.cm./min./100 c.cm. were recorded. This tremendous range, apparently made possible by abundant arteriovenous anastomoses (28), seems to be primarily concerned with temperature regulation rather than variations in metabolic requirements. The maximum and minimum flow values are subject to change on slow adaptation to high or low temperatures.

This investigator has also studied the spontaneous variations in peripheral vascular tone and their adjustments to the requirements of body temperature regulation. Using direct microscopic observation together with the volume pulse as an index of vascular tone he describes two types of spontaneous fluctuations. The first type, seen by microscopic observation, consisted of local isolated constrictions which might be due to intrinsic spontaneous contractions of the smooth muscle of the arteriole. Similar isolated constrictions have apparently been recorded by Hertzman (29, 30). The second type of periodic constrictions appeared to be simultaneous in the digits of all the extremities of the body and was accompanied by cardiac acceleration and a rise in the blood pressure. These co-ordinated constrictions are thought to be mediated entirely by the sympathetic nervous system. They occur independently of changes in the skin temperature or of external and psychic stimuli. It was found that this second type of vasomotor rhythm underwent striking modifications with changes in environmental temperature (1, 15). As the temperature of the environment increased, the amplitude of the volume pulse increased while the frequency of the periodic constrictions became less and less. These changes correspond to an increase in the average blood flow as measured by the venous occlusion plethysmograph. The average flow is adjusted to the requirements of heat elimination not by the maintenance of any steady vascular tone, but by the modification of an underlying rhythmic fluctuation between constriction and dilatation (1, 15).

That caution must be used in applying results obtained in the fingers and toes to the rest of the cutaneous circulation, has recently been emphasized (1, 8, 21, 29). Hertzman has employed the photo-electric plethysmograph in the investigation of the circulation in various cutaneous areas (8). He places the richness of the arterial supply to the various areas in the following descending order: finger pad, ear lobe, toe pad, palm of hand, skin of forehead and face, dorsum of finger, dorsum of hand, dorsum of foot, forearm, knee, and tibia. He found that there was a seasonal constancy in the volume pulse of the forearm, forehead, nose, and the dorsum of the hand and foot, in contrast to a warm weather dilatation in the finger pad, toe pad, and ear. The finger was found to be much more labile to the cold pressor test than the forehead and ear. There appears to be no necessary correlation between the richness of the arterial supply and the degree of vascular reactivity (8). Spontaneous vasomotor waves

were seen in all areas but were usually most marked in the fingers (29, 30). These waves usually consisted of constrictions in the extremities and dilatation in the head skin with variable responses in the ear and nasal septum (30). These waves may or may not synchronize in different areas and may or may not differ in direction and extent. Auditory and psychic stimuli, deep breaths, the cold pressor test, and breath holding all yield marked vasoconstrictor effects in the fingers and toes, in hand and foot skin, and in the nasal septum with variable effects in the head skin. In the forehead active or passive dilatation or no change usually results from constrictor stimuli (30). Inhalation of amyl nitrite usually causes constriction with late dilatation in the digits and marked dilatation in the forehead, ear, and nose (29). These results support the concept of selective vasomotor patterns in the circulation of the skin. The skin of the head participates only weakly in vasomotor reactions. Its similarity to the known behavior of the cerebral circulation suggests the possibility of using forehead skin plethysmograms as an index of the cerebral blood flow (30). The vascular reaction of the fingers to cold has been studied (31). On cooling a single finger, vasoconstriction occurs there and also in the "control" fingers of both hands. The constriction is usually most marked and most prolonged in the chilled finger. Dilatation begins after from two to eight minutes. It has been found (10) that photo-electric plethysmographic records of the normal human female breast showed a diurnal variation in the breast circulation. Breast records during pregnancy showed the wave form associated with the onset of menstruation. The peripheral vascular responses to the ingestion of food have been studied by Fierst and Abramson (32). A protein meal increased the blood flow in the hand in every case but a carbohydrate meal had no effect. In the forearm and leg a protein meal increased the blood flow if the experiment lasted over two and one-half hours. Carbohydrate produced no significant effect.

A number of physiological factors which affect resting blood flow to the extremities have been reviewed (2, 7, 21, 26, 33, 34). Resting blood flow at a bath temperature of 32°C is greatest in the hand, less in the foot, and least in the forearm (33). Kunkel *et al.* (26) also found the hand flow to be greatest under similar conditions although there was little difference between the forearm and foot. Reflex vasodilatation by heating another portion of the body produced the greatest increase in flow in the hand, less in the foot, and least in the forearm (33). This agrees with the findings of others (20, 26). With a bath temperature of 45°C (that is, equivalent to applying local heat), the increase in flow is considerably greater than that produced by reflex vasodilatation (33). This is confirmed by Wright and Phelps (7) who found that the direct application of heat and sciatic-nerve block were most efficacious in promoting the maximal blood flow to the leg, whereas reflex heat was about one-half as effective. No reflex vasodilatation was observed in subjects with paravertebral block, which indicated its dependence on the integrity of the sympathetic nervous system (33). It is agreed that the flow at 45°C is greater in the hand and foot than in the forearm and calf (26, 33, 34). However, whereas one group (26) found a greater percentage increase in flow over the value at 32°C to occur in the hand than in the forearm, Abramson's data (33) apparently show an opposite result. This point has a bearing on the question of the relative effect of local heat on the skin and muscle circulation. Changes in flow due to spontaneous variations in vasomotor tone or to changes in room temperature are largely avoided at a bath temperature of from 43 to 45°C (26, 33, 34).

The differentiation of "active" and "passive" arteriolar and venous components in the vascular reactions of the skin and extremities has recently been stressed (2, 13, 21, 35). By correlating flow, limb volume, and arterial and venous blood pressures, certain deductions can be made regarding the site of vascular reactions. From such observations, Abramson (21) believes that the diminution in limb volume produced by such stimuli as pinching, mental arithmetic, and hyperventilation is the result of both venous and arteriolar constriction in the hand, but almost solely of venous constriction in the forearm, and suggests that the forearm arterioles are relatively free of constrictor impulses. From a study of the spontaneous volume changes in the hand, Abramson and Katzenstein (35) concluded that alterations in the caliber of the venous bed were chiefly responsible and emphasized that changes in volume do not necessarily reflect alterations in arterial inflow. It has been found that the participation of the radial artery in constrictions of the finger arteries was irregular and most obvious in cases of massive circulatory disturbances (36). There is some evidence (37) that the maximal blood flow in the resting limb is determined to some extent by the diameter of the larger supplying arteries.

The effect of tobacco smoking on the peripheral circulation has been studied by several investiga-

tors (27, 38, 39). Smoking produced the greatest vasoconstriction in the fingers (39) and in the hands and feet (27), whereas in the forehead (39) and forearm (27) no effect was produced. Since deep inspiration may cause constriction in the hands and feet with relatively little effect on the forehead skin (39), the question arises as to whether the observed decreases in flow are due to deep breathing rather than to the actual smoking. That deep breathing alone can account for the greater part of the decrease is supported by the fact that puffing on an unlighted cigarette (39), or inhaling smoke from denicotinized cigarettes (38) produced as greatvasoconstriction as actual smoking, or more.

The application of photo-electric plethysmography to the study of peripheral vascular disease has been discussed (40). In arteriosclerosis and in thrombo-angiitis obliterans, the "maximal" blood flow to the foot may be reduced as much as 50 per cent without the appearance of symptoms or trophic changes (34). When the flow is reduced to 33 per cent of normal, symptoms and trophic changes usually appeared. In both of the above conditions, cases were observed which presented severe intermittent claudication in the presence of a normal foot flow; hence the latter does not rule out an inadequate circulation to the muscles of the calf. An abnormally high blood flow to the finger tip in simple clubbing has been reported (41). In hypertrophic pulmonary osteo-arthropathy, the flows were normal, however.

The peripheral blood flow in hyperthyroidism has received considerable attention (41–46). Sheard and Williams (45), and Kirklin, Plummer, and Sheard (44) studied the skin temperature of the extremities in normal subjects and in hyperthyroid subjects before and after medical and surgical therapy. They found that the temperature of the toes was higher with an increasing basal metabolic rate and fell to normal limits when this rate returned to normal. This result is supported by Stewart and Evans (43) who found that the peripheral blood flow (measured by a calorimetric method), the skin temperature, and the basal metabolic rate followed the same trend in hyperthyroid patients before and after therapy. Abramson and Fierst (42, 46) found an increased flow to the forearm and leg but not to the hand in hyperthyroidism. After the administration of Lugol's solution and subtotal thyroidectomy the forearm flow returned to normal in from eleven to sixty-eight days. Normal finger flow in hyperthyroidism has been reported by Mendlowitz (41).

The peripheral blood flow in hypertensive subjects has been reinvestigated. Abramson (47) compared the forearm flow in 38 normal and 28 hypertensive subjects using a venous-occlusion plethysmograph with the precaution to exclude the venous return from the hand. The error involved in measuring forearm flow if this precaution is not taken was first pointed out by Grant and Pearson (20) and subsequently confirmed by others (26). Abramson found a definite increase in the forearm flow in hypertensive subjects and suggests a re-examination of the statement that increased vascular tone exists at the periphery in hypertension. He explains the disagreement between his results and those of earlier workers (48, 49) as being due to the fact that these investigators did not exclude venous return from the hand. Stead and Kunkel (50), however, found the flow to the foot, hand, and forearm to be essentially the same in normal and hypertensive subjects and believe that the peripheral resistance is uniformly raised. Mendlowitz (41) reports a normal finger flow in hypertension.

LYMPH

A review of the peripheral circulation would be far from complete without consideration of the lymphatic system, particularly that of the skin. An understanding of the structure and behavior of the cutaneous lymphatics is important in appreciating their response to injury and infection of the skin, as well as their role in many other cutaneous and circulatory phenomena. By means of a micro-injection technique and dyes of varying molecular weight (diffusibility), the characteristics of the cutaneous lymphatic capillaries can be directly observed and have been studied in animals and in human subjects (1).

Using the afore-mentioned technique, Hudack and McMaster (1) found that the cutaneous lymphatic capillary is a closed channel from which dyes escape secondarily. (The idea of the lymphatics as closed tubes completely separated from the surrounding tissues by a continuous layer of endothelium was presented by Sabin in 1916 (33).) Hudack and McMaster found that there was an active flow of lymph in the mouse's ear under ordinary conditions and that the movement of dye was always toward the main collecting system. Distal flow of the injected dye was prevented by valves in the lymphatics as well as by fluid flow. The same dyes were found to be retained by both the lymphatic capillaries and the blood capillaries, and the walls of both were permeable to the same dyes. Particulate matter, such as India ink, did not pass through the wall of the lymphatic. The lymphatic capillary appeared to differ from the blood capillary in that the

former did not seem to possess any gradient of permeability such as that ascribed to the latter. It was concluded that the wall of the lymphatic behaves as a semipermeable membrane.

Having observed some of the general properties of the lymphatic capillary, McMaster and Hudack (2) studied the effect of various factors on its permeability. Obstruction of the lymphatic capillary of the mouse's ear was found to lead to an increased permeability without dilatation of the vessels. The cutaneous lymphatic capillary was found to be very sensitive to pressure, as illustrated by the fact that cutaneous pressure insufficient to injure the epidermis resulted in a prompt increase in lymphatic permeability confined to the area pressed upon. This increase in permeability, though transient (lasting for a few hours), was marked to the extent of allowing the passage of hemoglobin through the lymph capillary wall. Warming the ear to 43°C, exposure to sunlight, and slight chemical irritation, all increased the lymphatic capillary permeability. This increase in permeability precedes the development of edema. These authors point out that much of the usefulness of the lymphatic capillary depends upon the state of permeability of its walls and that changes in this permeability must alter the function of the lymphatic system as a channel and must be in part responsible for the local accumulation of fluids.

Adapting their technique to living human skin, the authors observed directly the response to intradermally injected dyes (3). They found the cutaneous supply of lymph capillaries to be very abundant. Any scratch of the skin, even though not penetrating the epidermis, gives rise to conditions conducive to lymphatic absorption. So closely meshed are the lymphatics of the skin that even a fine hypodermic needle cannot avoid tearing some of these vessels if introduced into the skin. Hence intracutaneous injections must necessarily be to some extent intralymphatic. Dyes injected intracutaneously frequently tend to spread through the superficial plexus of lymphatic vessels, but in some individuals the injected material may tend to enter the deeper lymphatics at once. The difference in behavior is explained as being due to physical factors determined by skin texture. The influence of skin texture on the rate of spread of intracutaneously injected dye was found by Levin, Silver, and Berkowitz (34) to vary directly with the looseness of the skin, hence to be more rapid with increasing age. McMaster and Hudack (3) found that dyes introduced intracutaneously in the forearm reach the axillary lymphatics in a few minutes even with the arm at rest. This finding suggests that for certain substances, strict localization of an intracutaneous inoculation is a very transient phenomenon. Stroking the human skin with a blunt instrument to produce a wheal causes the lymphatic capillary walls to become permeable to such an extent that they no longer hold back dyes for which they were normally a temporary barrier at least. These authors found that the cutaneous lymphatic capillary of the human being has a permeability and behavior similar to those of the mouse's ear.

In a subsequent study (4), these authors reported that the behavior of the severed lymphatic capillaries differed greatly from that of the small blood vessel. Unlike the blood vessels, the lymphatic capillaries remain open after injury for as long as forty-eight hours; their gaping ends serve as open channels for substances introduced into the wound and provide a reasonable explanation for the fact that infection following skin incisions or injury is predominantly along the lymphatics. All around an injury the lymphatics are at first rendered abnormally permeable, as are the blood vessels. At a later time, while the blood vessels are still more permeable than normal, the lymphatics permit far less dye to escape from the area than usual. The retention of dye at the site of inflammation was also observed by Menkin (6), who found that trypan blue injected directly into the inflamed area fails to reach the regional lymphatic nodes. He explained this finding as due to the occlusion of the lymphatics and to fibrin network in the inflamed area. Drinker, Field, and White (5), in their study of sterile inflammation, found that the rise in lymph pressure in the warmed extremity followed the rise in venous pressure which occurred immediately in a region subjected to sterile inflammation. They suggest that the gelatinous material in the inflamed area, rather than the lymphatic occlusion, may account for the localization of dye. They further describe how trypan blue, fixed in an extremity with sterile inflammation, appeared in the lymph from this area after the mere handling of the dog's leg. Such observations emphasize the importance of immobilization and posture in facilitating the localization of infection or in reducing systemic absorption from an infected area to a minimum (35).

That posture is an important factor in cutaneous lymphatic capillary flow was indicated by further observations of McMaster (7). He found that in the horizontally placed normal limb at rest there is only a slight flow of lymph in these capillaries (3). In a normal arm or leg hanging downward lymph flow ceases (7) and the volume

of the dependent limb increases (36). It was observed that sufficient elevation of the previously dependent arm or leg caused the lymph flow to become active. Partial obstruction of the veins from without causes lymph flow to cease in the skin of the obstructed arm and when the obstruction is released there is a very active flow of lymph accompanying the active hyperemia which follows release of the venous obstruction. The lymph flow is even greater following release of a total circulatory obstruction, whether or not the limb has been previously engorged with blood. It was further observed that in the limb with a total circulatory obstruction the lymphatic capillaries in the ischemic areas (Bier's spots) are constricted while those in the congested areas are dilated. Both constricted and dilated lymphatic channels show rapid drainage after relief of the obstruction.

Observations on the effect of sucking the skin following the intradermal injection of dye indicated that while this practice may remove part of the foreign material, much of it is driven into the lymphatics draining the site of the injection (7).

A further point of interest in considering the proper posture, support, and dressing for an extremity is suggested by the observation, "Lymph flow was observed to cease in the subcutaneous channels when by means of a cuff about the upper arm an external pressure was applied which was far less than that required to obstruct venous flow."

A study of the lymphatics and lymph flow in human beings with cardiac edema demonstrated that the skin lymphatics in edematous areas were patent, full of fluid, and much widened (8). The escape of dye from the lymphatic channel was more rapid than in the normal skin; a retrograde distribution of the dye with subsequent appearance at a site distal to that of injection was interpreted as evidence of valvular incompetence secondary to dilatation of the lymph channels. Observations on patients with nephritic edema revealed that while the lymph capillaries were wider than normal there was no evidence of valvular incompetence. Instead of the lymphatic stagnation observed in cardiac edema, a lymph flow considerably greater than normal was found, even when edema fluid was accumulating. The cutaneous lymph flow was also greater in the period of fluid equilibrium and was very rapid in periods of diuresis. Watkins and Fulton found that diuresis induced in the dog by mercuperin was accompanied by a reduced flow of lymph from the thoracic duct (37). It would be interesting to know whether or not an increased cutaneous flow of lymph occurred in these animals.

Parsons and McMaster (9) perfused the ears of rabbits with defibrinated blood, using an apparatus which permitted the propagation or withdrawal of a pulse wave at will, but with the same "systolic" pressure in both instances. In the absence of pulsation they found almost no flow of lymph, while in the presence of a pulse wave there was a rapid flow of lymph. Non-pulsatile perfusion resulted in a slight flow of lymph during the development of an edema, while under similar conditions the pulsatile flow of blood resulted in the formation of large quantities of lymph.

The synchronous pulsation of lymphatics and arteries was recorded by Cressman and Blalock who pointed out that the transmitted arterial pulsations in conjunction with competent lymphatic valves probably promote lymph flow in the resting tissue (38). McMaster and Hudack further demonstrated (10) that the pulsation of the blood vessels in the perfused rabbit's ear caused a greater formation and flow of lymph, a greater interstitial spread of dye, and a much more rapid removal of dye from the tissues, than those observed when the circulation was of the same pressure but non-pulsatile in character. The change in vessel caliber caused by the pulse appears to produce its effect by squeezing and weaving the formed elements of the tissues. This impression is in harmony with the facts that the pulse exerts its greatest effect before the formed elements of the tissues are separated by edema fluid, and that active hyperemia preceding edema is accompanied by increased dye spread and by a greater formation and flow of lymph (10).

The spread of dye in the edematous ear was found to be the same whether or not the ear was living, so the authors (11) concluded that the spread was by diffusion. This study of the effect of normal and pathological factors on the spread of dye in the tissues revealed that the spread is greater in the quiet living ear of a normal animal than in one just killed; that it is quite rapid during the early stages of edema formation; that it is greater in normal animals actively moving about; and that it is greatest of all in tissues subjected to gentle intermittent changes in external pressure.

A study of the method of interstitial spread of vital dyes (12) provided further information on the physiological conditions existing in connective tissue. These tissues are nourished by fluid from the blood vessels which may be returned to the circulation directly or indirectly by way of the lymphatics. The question is raised as to whether or not actual tissue spaces do exist and, if so, what is their function. With the use of an ultrapak microscope and a diffusible dye, pontamine sky

blue, which does not stain the tissues during the time of the experiment, it was possible to observe directly the passage of the dye from the lymphatics into interstitial spaces of the mouse's ear. According to these observations, the dye appears outside of the lymph channels as minute wavy lines of color which can be bent and twisted by pressure from a microprobe and will still resume their original position when the pressure is released. The bristly lines of color are thought to be formed by dye moving between or along connective-tissue fibers. With the occurrence of the edema which is eventually produced by the presence of the dye, the lines of color disappear and the coloration becomes diffuse and freely movable. If edema precedes the introduction of dye into the lymph channel, the dye escapes as a freely movable colored cloud rather than as discrete lines of color, and the manner of its passage into the tissues is completely changed. It was observed that in dehydrated or dead animals the bristles of color were more evident than in normal ones, which emphasized some of the characteristics of the mode of transmission of dye through the tissues. When the amount of tissue fluid was increased by the intravenous injection of large amounts of fluid, the colored bristles were seldom seen. Free fluid was not demonstrated in normal tissue and the authors believe that the surfaces of connective-tissue fibers serve as pathways for the extravascular transport of large molecules. Observations were carried out on a number of different tissues and always with the same result. It was also suggested that a perifibrillar movement of substances may be the method by which nutriment is supplied to the tendons and the central nervous system.

With still more diffusible dyes (13), the means of escape from the lymphatic channels into the surrounding tissue was observed to be the same as for pontamine sky blue, if the vessel was uninjured. Since differences in chemical characteristics and diffusibility did not alter the mode of interstitial movement, the principle involved appears to be a general one. The extension of dye from the lymph channel seems to be conditioned by the form and structure of the connective-tissue fiber and this process can be greatly increased and hastened by intermittent external pressure. This concept assigns to the connective-tissue fibers an important role in the spread of substances through tissues subjected to pressure changes.

In summarizing these experiments (13), therefore, it may be said that they give evidence of the existence of a tissue matrix in the organ but furnish no evidence for the presence of free interstitial fluid in normal tissue. In tissue subjected to chemical irritants or in frankly edematous tissue, the presence of free interstitial fluid can be readily demonstrated by this method of study. Under these abnormal conditions the mode of dye extension is completely changed and it appears in the tissues as a colored cloud that is freely movable by pressure. Thus it would appear that if any free fluid exists in the tissues it must be present in very small amounts, that the large spaces seen between connective-tissue fibers in fixed specimens are probably artifacts, and that normally at least part of this space is occupied by an intercellular matrix. The authors point out that this work does not conflict with the concept that from 20 to 30 per cent of the body's water is extracellular and extravascular. This work gives no evidence concerning the amount of extracellular and extravascular fluid, but is highly suggestive regarding its state, indicating that this fluid is not a freely movable liquid filling interstitial spaces as lacunæ. Elsewhere it has been reported (14) that no brownian movement can be observed directly in the tissues, another observation which suggests the absence of interstitial fluid. However, Maurer has collected a straw-colored fluid from the extracellular extralymphatic spaces of frog muscle (27).

Further work (15) directed toward an understanding of the factors involved in lymph formation indicated that the take-up of microscopic amounts of fluid by the cutaneous connective tissue of the mouse is an intermittent process. This is true whether or not the fluid is under pressure and occurs in the presence of intact, uninjured blood and lymphatic capillaries. Furthermore, it was shown (16) that the spontaneous uptake of fluid by the interstitial connective tissue of the skin is augmented by hyperemia of the tissues, but that the uptake is still intermittent. Venous obstruction caused an outflow of fluid from the tissues into the injecting apparatus, and when the obstruction was released there was a rapid but intermittent uptake of interstitial fluid during the stage of reflex hyperemia which followed release of the obstruction. Depriving the skin of its circulation results in a cessation of fluid up-take by the tissues at atmospheric pressure, but a continuous flow can be caused by a positive fluid pressure. The up-take of edema-forming fluids forced into the skin of either living or dead animals is also by a continuous process as is the up-take of serum and sperm oil. These results indicate that the passage of interstitial fluid into the blood vessels and also its escape may both be intermittent processes under normal circumstances.

McCarrell (28), using passive motion to stimulate a uniform flow of cervical lymph, found that very little absorption of fluid from the nasopharynx occurred during its perfusion with Ringer's solution, but that a large increase in cervical lymph flow followed perfusion with distilled water.

A study of the lymphatic pathway from the nose and pharynx by Yoffey and Drinker (17) demonstrated that trypan blue and another dye, T-1824, may be recovered from the cervical lymph from fifteen to thirty minutes after they have been placed in the nose of the cat or monkey; similar results with different time intervals were obtained with the rabbit and dog. The two dyes mentioned were also absorbed directly into the blood from the nose. When a fine suspension of particulate matter (hydrokollag) was introduced into the nose instead of a solution of dye, none of it was ever recovered in the cervical lymph. Neither the dye nor the particulate matter, though left in the nose for as long as six hours, was found to pass through the cribriform plate and reach the interior of the cranium. Egg albumin was recovered in cervical lymph after its introduction into the nose of various animals (18), while similar experiments with horse serum gave negative results and those with serum albumin were negative in cats, but positive in a rabbit. Vaccinia virus dropped into the nose of susceptible animals was not recovered from the cervical lymph in less than twelve hours (19); but from twelve hours up to seven days, a stream of virus was found to enter the blood through the cervical lymphatic ducts. The passage of the virus through the regional lymph nodes following intracutaneous inoculation was demonstrated; also, the *in vitro* fixation of the virus by lymphocytes. In another study (20) employing rabbits, it was shown that the regional lymph nodes may serve as a source of the neutralizing principle for vaccinia. The Toomey "T" strain of poliomyelitis could not be detected in cervical or thoracic-duct lymph after intranasal or intracerebral inoculation (21).

The passage of rabbit virulent Type III pneumococci from the nose or trachea into the lymphatics draining the involved area has been shown to occur (22). The lymph collected during a four-hour period was rarely found to be negative and was frequently positive at the end of the first hour. The organisms were found first in the lymphatics and subsequently, in a few instances, were recovered from the blood during the four-hour test period. The intravenous administration of antiserum from two and one-half to three hours before the installation of the organisms decreased the frequency of recovery of the organism from the lymph or blood as well as the length of time during which the organism could be recovered from the efferent lymphatics. It has also been shown that viable streptococci injected into the paranasal sinuses or into the parapharyngeal lymph nodes may be recovered from the lungs, liver, and spleen (29).

A study by McCarrell (23) of the effect of hyperthermia on the cervical lymph flow of the dog has demonstrated two periods of increased flow when the temperature of the body is elevated by raising the room temperature and interfering with the normal process for body cooling. The first rise in the rate of cervical lymph flow (1 to 4.5 times the control values) occurred at a body temperature of from 38.3 to 41.1°C, and was thought to be due to peripheral hyperemia. Peripheral hyperemia increased the rate of capillary filtration and resulted in an increased amount of lymph, which was shown to have a lower protein content than the lymph collected during the control period. The second rise in lymph flow (3 to 18 times the normal) appeared at a temperature of from 41.9 to 43.5°C, and was brought about by circulatory failure and the anoxemia, venous stasis, and increased venous pressure which occurs in circulatory collapse.

Maurer has shown (24) that exposure to either low oxygen or high carbon-dioxide tension causes an increased production of cervical lymph in the dog. It was found that following the initial exposure to a low oxygen tension, it became increasingly difficult to produce this effect on lymph flow by subsequent exposures. It was also found that an increased production of lymph occurred during rebreathing experiments when the arterial oxygen saturation reached 75 per cent, which is equivalent to an altitude of 17,000 feet, and that the production of lymph was greatest when the arterial saturation reached 52.5 per cent, which is equivalent to an altitude of 20,000 feet.

It was also shown that exposure to low oxygen tension resulted in damage to cardiac blood capillaries, as indicated by a greatly increased flow of cardiac lymph, and subsequent exposure to pure oxygen failed to restore the normal capillary permeability.

While it was found that the concentration of protein in the lymph varied inversely with the rate of lymph flow, yet the total amount of protein contained in the lymph in milligrams per minute increased with the increased flow and decreased as the flow subsided. Coincident with the increased output of lymph proteins a decrease in the concentration of serum protein was observed;

this decrease seems a little surprising to the reviewers inasmuch as the relative loss of fluid from the blood apparently exceeded that of protein.

Acacia injected intravenously appeared regularly in the lymph, equilibrium between the serum and lymph acacia occurring after from forty minutes to two hours. The albumin to globulin ratio in the lymph was found to remain constant for all rates of flow. The increased passage of protein and of acacia into the lymph from the blood stream brought about by decreased blood oxygen or increased blood carbon-dioxide tension is believed to be indicative of increased blood capillary permeability with the loss of fluid and protein from the circulating blood.

A technique has been described by Drinker and coworkers (25) for collecting the entire flow of cardiac lymph from the dog. By this technique they have found that the cardiac lymph flow varies directly with the vigor of the heart beat and that it increases with dilution of the plasma proteins as does the lymph flow from other sites in the body (26). They found that cardiac lymph is a filtrate of the blood capillaries, that it normally contains albumin and globulin, and that it clots; also that horse serum and gum acacia injected intravenously can subsequently be demonstrated in cardiac lymph, which is indicative of the permeability of the cardiac capillaries.

Anatomical studies of the lymphatic system of the heart have been reviewed and extended by Patek (30). The continuous plexus of the subepicardial lymphatic capillaries of the dog contains numerous valves. Lymph vessels are received from the myocardium and these converge to accompany blood vessels; they eventually form a single trunk which drains the entire heart. Gray, using thorotrast as a means of demonstrating the lymphatic channels, has studied the relation of the lymph vessel to the spread of cancer (39). He states that the lymphatic capillary has a wall of true endothelium and that a collecting trunk lymphatic vessel consists of endothelium surrounded by smooth muscle and adventitia. He describes the lymphatic valves as two semilunar cusps in exact apposition to one another, and says they occur at more frequent intervals than those contained in the veins. Gray concluded that for operable cases of cancer the spread should be considered as entirely embolic.

That lymphatic drainage is essential was indicated by the report of Blalock and his associates (40). They found that complete lymphatic blockage was difficult to achieve in dogs or cats, but that an almost total disappearance of eosinophils and lymphocytes from the peripheral circulation resulted from this stoppage when it was achieved. The 3 dogs in which an adequate lymphatic obstruction was obtained soon became moribund. Extravasation of chyle into the tissues and distention of the lymph channels were conspicuous autopsy findings on abdominal organs. No lymphaticovenous communications were demonstrated.

For a comprehensive treatment of existing information on the lymphatic system up to 1933, the reader is referred to a volume on that subject by Drinker and Field (31). More recent material can be found in a review by Warren (32) written in 1940.

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ADDENDA

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Boldrey, E., and McNally, W. J.: Chordoma of the Basi-Occiput and Basisphenoid; Report of 4 Cases. *Arch. Otolaryngol.*, 1941, 33: 391.

Chordoma of the basi-occiput and basisphenoid may be confined to the cranium and the cranial cavity, or it may erode into the nasopharynx. In the latter event biopsy of tissue obtained with a large needle under vision by means of the nasopharyngoscope is simple, safe, and conclusive. Smear preparations of chordoma are quicker to make and more uniform than cut sections, and show the true type of tumor better.

Radium and roentgen therapy will produce a definite regression of the tumor in some cases and should be given a trial in the treatment of patients with this disease.

The authors report 4 cases studied at the Montreal Neurological Institute and the Montreal General Hospital. NOAH D. FABRICANT, M.D.

Kazanjian, V. H.: Treatment of Benign Tumors of the Jaw. *J. Am. Dental Ass.*, 1941, 28: 208.

Benign tumors of the jaw arise from two sources: the tooth germ tissues, during tooth development, and epithelial remnants retained in the jaws. They may be either cystic or solid in character. Cystic tumors may be divided into the following groups:

1. Dental root cysts, called radicular or peridental cysts
2. Follicular cysts, called dentigerous cysts
3. Traumatic cysts
4. Incisive canal cysts
5. Adamantinomas

Clinically, the cysts have many points in common: they grow slowly and form a definite cavity which is surrounded by healthy bone; they usually do not cause any discomfort, especially in the early stages, unless the fluid in the cavity becomes infected; they may become large and may weaken the jaw bone; and they are benign and their destructive effect is only local.

X-ray examination is the principal means of diagnosis, but it may be difficult to differentiate giant-cell tumors from adamantinomas, and metastatic tumors of the jaw from myelomas by this method.

No single surgical procedure is applicable in the treatment of all types of cases. In general, operative treatment of dentocystic tumors consists of (1) exposing the cavity, (2) removing the cystic contents and the membrane, and (3) eliminating the cavity. The elimination of the cavity is the most important factor in the treatment. The various methods used are described in detail.

Adamantinomas are sometimes called multilocular cysts, or polycystic ameloblastomas. They are true epithelial tumors, and are thought to originate from the epithelial cells of the enamel organs. They are more destructive to the normal bone of the jaws, and are, therefore, locally malignant. If imperfectly treated, they may undergo malignant degeneration and invade the neighboring soft tissues.

The treatment is surgical, and it is essential to remove more bony tissue than appears to be involved in the x-ray pictures. Often the entire thickness of the jaw is involved, and resection of the mandible is accepted as the only method promising a complete cure. Treatment of the deformity resulting from the radical operation for adamantinoma should be uppermost in the surgeon's mind.

Giant-cell tumors in the maxilla and mandible are usually benign single tumors, which may be divided into two main groups: peripheral giant-cell tumors and central giant-cell tumors. The peripheral type usually involves the alveolar processes close to the teeth. It is often confused with epulis, a true fibroma, which does not contain giant cells. The central type originates from the cancellous part of the bone. It is often found at the angle of the jaw and at the symphysis.

Giant-cell tumors of the jaw are benign. Though they cause destruction of healthy tissue by expansion, they do not metastasize nor extend into the lymphatic tissue. In the treatment, complete surgical removal of the mass is the method of choice. Since this type of tumor is known to have a tendency to recur, it may be advisable to curette the bony cavity thoroughly, after the tumor has been shelled out. This procedure should be followed by radiation therapy or cauterization of the surface of the cavity with an escharotic solution. SAMUEL KAHN, M.D.

Bailey, H.: The Treatment of Tumors of the Parotid Gland, with Special Reference to Total Parotidectomy. *Brit. J. Surg.*, 1941, 28: 337.

It is Bailey's belief that by instituting some radical alterations in teaching and practice, all but a very few parotid tumors can be placed in a category of absolute curability. He advocates six essential modifications of current teaching. These are:

1. Most of the tumors of the parotid gland are to be considered radioresistant.
2. If recurrence is to be kept at the minimum, the capsule of encapsulated tumors must be completely removed.
3. Adequate exposure should be employed.
4. Salivary fistula following operations for parotid tumor occurs so rarely that it should not be regarded as a deterrent to the radical surgery advocated.

5. The surgical anatomy of the parotid gland should be revised. Complete extirpation of the gland with preservation of the facial nerve is a feasible undertaking for which there are definite indications.

6. Even when facial palsy occurs, the deformity can and should be alleviated.

In his discussion of the technique of total parotidectomy, Bailey describes an adequate incision, mobilization of the superficial lobe, division of the isthmus, and removal of the deep lobe.

NOAH D. FABRICANT, M.D.

EYE

McKee, S. H.: Malignant Melanoma of the Uveal Tract; An Analysis of 42 Cases. *Arch. Ophth.*, 1941, 25: 238.

Since 1924, 42 cases of sarcoma of the uveal tract have come under observation. The disease is relatively rare. It is one of the most malignant of ocular diseases but it rarely occurs in both eyes. The prognosis as regards life in a large percentage of cases is absolutely unfavorable. Local recurrences in the orbit and general metastasis frequently develop after removal of the eye.

Of the 42 patients whose cases are recorded here, 23 were men and 19 were women. The age incidence was as follows:

Under twenty years	1 patient
From twenty to twenty-nine	3 patients
From thirty to thirty-nine	5 patients
From forty to forty-nine	7 patients
From fifty to fifty-nine	9 patients
Sixty years and over	17 patients

In the great majority of cases, some visual disturbance brought the patient to consultation. In 5, there was a definite history of previous injury to the eye.

In 1931, Callender described 4 or perhaps 5 specific types into which all primary malignant uveal neoplasms may be classified:

1. Spindle-cell type.
   a. These tumors are usually fairly heavily pigmented.
   b. The cell is usually lightly pigmented.
2. Fascicular type. Pigmentation is usually scanty.
3. Epithelioid type. This type varies greatly in the degree of pigmentation.
4. Mixed-cell type. The tumors are very heavily pigmented.

Callender and Wilder further classified these tumors by their argyrophil fiber content:

1. Tumors having no fibers, or fibers only in the interlobular stroma.
2. Tumors having areas with and areas without fibers. This group is subdivided into (a) tumors having a definite preponderance of fiberless areas, (b) tumors having areas with and areas without fibers in approximately equal numbers, and (c) tumors having a preponderance of areas containing fibers.
3. Tumors having, in all areas, fibers forming a network about individual tumor cells.

In the classification of tumors by fiber content, the malignancy of the tumor appears to be inversely proportional to the degree of intercellular invasion by argyrophil fibers.

The outstanding facts brought forward in a recent article by these authors are that there are no deaths from tumors of the spindle cell (subtype a), or from tumors of Group 3 in the classification according to fiber content, and that in every case in which no argyrophil fibers appeared among the tumor cells, the patient has died.

Freedom from metastasis for the usual five-year period is not a sufficient interval to determine malignancy.

McKee wishes to emphasize that a serous detachment of the retina may be the primary symptom also of metastatic carcinoma of the chorioid. In a patient past his fortieth year a spontaneous detachment of the retina in a non-myopic eye should be considered with the greatest suspicion. The mixed-cell tumor appeared to be the most malignant in Callender's first tabulation, but now the epithelial group is placed ahead of the mixed-cell type in malignancy rating.

Unquestionably the follow-up in these cases tends to verify the statement that the spindle-cell (subtype a) tumor is relatively benign.

LESLIE L. MCCOY, M.D.

EAR

Grove, W. E.: An Evaluation of the Ménière Syndrome. *Ann. Otol., Rhinol. & Laryngol.*, 1941, 50: 55.

In the Ménière syndrome we have a fairly common condition affecting middle life, and characterized by a triad of symptoms—vertigo, tinnitus, and deafness. It is of unknown etiology and little known pathology. In the etiology, more serious consideration must be given to allergy, avitaminosis, and disturbances in the endocrine balance than has hitherto been accorded to them.

Many prominent investigators maintain that the chief pathological feature of this condition is a waterlogging or edema. This condition is probably a metabolic disturbance, but whether it is a disturbance of the water balance or of the metabolism of the sodium ion, or both, is not entirely clear.

The operation of this disturbance in metabolism seems to find its greatest expression in the labyrinth where it initiates the attacks of vertigo, the deafness, and probably also some of the tinnitus. That not all of the tinnitus originates in the end organ is evidenced by the fact that it persists in many cases after total destruction of the labyrinth or a severance of its nerves. May it not be that this same waterlogging process is operating both in the end organ and in the central cochlear nuclei?

The success of the dehydration treatment and the sodium-elimination treatment, as well as of the more

recent treatment with histamine when carried out under proper hospital supervision, suggests that the patient should be given the opportunity of trying medical treatment before submitting to surgical intervention.

Grove believes that surgical intervention should be reserved for those patients who have not responded to a medical regime, for those who for economic or other reasons cannot be kept on a medical regime, and for those whose occupations are such as to preclude the possibility of any return of the vertigo because of carelessness in following a medical regime.

Of the surgical measures proposed, it would seem that total section of the acoustic nerve is indicated for those whose hearing in the affected ear has fallen below a usable level, and that the differential section of the vestibular portion of the nerve is the operation of choice for those with usable hearing. These operations should not prove hazardous in the hands of the competent neurosurgeon.

NOAH D. FABRICANT, M.D.

Lindsay, J. R.: Chemotherapy in the Treatment of Complications of Acute Middle-Ear Suppuration (Petrositis and Meningitis). *Ann. Otol., Rhinol. & Laryngol.*, 1941, 50: 159.

The treatment of otitic complications has undergone two radical changes recently: (1) the use of chemotherapy, and (2) the use of adequate methods of diagnosis and surgical approach to the deeper structures of the temporal bone.

An analysis of a group of clinical cases is made with the object of determining the causes for failure or success.

The group comprises 10 cases and two types of complications—meningitis and petrositis. Certain conclusions are drawn from a study of these cases.

Diffuse meningitis of otitic origin has recently been cured by the use of chemotherapy without surgery, and in several of the cases reported here, the same favorable result might possibly have been obtained without operation.

It is well demonstrated that in the presence of an abscess inside the dura, or a focus of necrosis in the temporal bone, either large or moderate in size, and in the presence of an extradural abscess, the use of chemotherapy alone fails to sterilize the focus. Concentrations of 14 mgm. per cent and more have been maintained for from several days to two weeks without success. Symptoms have usually been relieved but have reappeared, sometimes before, though usually after withdrawal of the drug.

Of 10 cases reported 6 were of this type, with large foci of suppuration in which surgical drainage was essential. It appears that chemotherapy alone is most likely to be successful in cases in which a complication has developed rapidly by extension along vascular channels before there has been gross destruction of bone, in cases with bone presenting pneumatization of the limited small-cell type, or in the presence of partial sclerosis.

Chemotherapy would appear to relieve the urgency of surgery but in those cases in which clinical evidence points to suppuration in the mastoid or petrous tip, surgical intervention is advisable.

The masking of symptoms can be interpreted as a desirable effect, as it indicates a definite limitation of the infective process.

Clinical observation appears to indicate that the efficacy of drug therapy depends greatly on the extent of pneumatization. Suppuration in extensively pneumatized bones tends to resist chemotherapy even in the early stages.

Recurrence or exacerbation of the meningitis occurred in 3 cases after the blood concentration had been allowed to decrease to 6 or 7 mgm. per cent. Best results were obtained by creating an initial blood level of 15 mgm. and maintaining it for from five to seven days. No serious toxic effects were observed in any of the cases treated, but the author believes that the patient should be under constant observation.

JOHN F. DELPH, M.D.

MOUTH

Lehmann, J.: Carcinomas of the Lips and Tongue, with Special Consideration of the Cases Treated at the University Surgical Clinic in the City of Freiburg During the Years from 1928 to 1938 (Ueber Lippen- und Zungencarcinome unter besonderer Beruecksichtigung der in den Jahren 1928 bis 1938 in der Chirurgischen Universitaetsklinik der Stadt Freiburg behandelten Faelle). Freiburg: Dissertation, 1940.

During the years from 1928 to 1938, 39 patients with carcinoma of the lip were treated at the Freiburg University Surgical Clinic. The practically generally known fact that the upper lip is only rarely affected could be confirmed as there were only 3 cases. The proportion of men to women affected amounted to 92 and 8 per cent, respectively; the average age was sixty-two years, the proportion of smokers was 81.2 per cent, and that of pipe smokers 31.2 per cent.

After a general discussion of the disease picture, the etiology and the prognosis, which is considered as relatively favorable, the treatment was discussed:

It consists chiefly of the radical operation of the tumor with extirpation of the regional lymph nodes when their palpability arouses the suspicion of metastasis. In 84.8 per cent of the cases freedom from symptoms from one to ten years and in 54.5 per cent freedom from symptoms for at least five years could be achieved.

During this same period of time 15 cases of carcinoma of the tongue were also treated; the clinical aspects of these cases and their pathogenesis were also discussed. In contrast to the prognosis in carcinoma of the lips, that of malignant tumors of the tongue is extremely unfavorable. The proportion of men to women in these cases was 87 and 13 per cent, respectively, and the average age was fifty-six and two-tenths years. The tumors were situated mostly at the lateral borders of the tongue.

Whereas the cases of tumor of the tongue with a fatal prognosis from the outset were subjected to roentgen irradiation alone, the other cases were subjected to radical surgical removal of the tumor with extirpation of the palpable regional lymph nodes at the same time. Prophylactic roentgen irradiation was carried out in the presence of positive histological finding. In 30.5 per cent of the cases treated freedom from symptoms was achieved for from two and five-tenths to nine years and in 23 per cent for at least five years.

In regard to the etiology of carcinoma of the lip, it is assumed that smoking might contribute to its development. Among the 39 cases discussed, 26 patients were found to be smokers or chewers of tobacco, and of these only 10 were pipe smokers and 7 were both cigar and pipe smokers. Occupationally, they were mostly farmers, drivers, and wood workers, namely, individuals with occupations more or less subjected to weather conditions. Just as in other carcinomas, mechanical, thermic, and chemical factors seem to play a role in the development of carcinoma of the tongue. Further details of the pathogenesis are not yet known.

(HAAGEN). LOUIS NEUWELT, M.D.

NECK

Lahey, F. H., and Nelson, H. F.: Branchial Cysts and Sinuses. *Ann. Surg.*, 1941, 113: 508.

The generally recognized theory as to the cause of branchial cysts and sinuses is that based on Wenglowski's work, as interpreted by Meyer. Meyer believes that the branchia belong to the head and not to the neck, and that any congenital pathological condition referable to them in human beings must rest along the mandible adjacent to the hyoid bone and the cornu of the hyoid bone. Nothing, in his opinion, below the lower level of the hyoid bone has any genetic relation to the branchia and all congenital anomalies caused by incomplete retrogression of the branchia must be located in the region around or above the lower border of the hyoid bone. Any congenital anomaly below this level is in definite relationship with the pharyngothymic duct and must be classified as a lateral cyst or fistula from this duct.

Bailey believes that he disproves Wenglowski's theory that the branchia never leave remnants in the neck below the level of the hyoid bone by citing a case of a persistent branchial cartilage found in the lower third of a child's neck, a position where a branchial fistula commonly opens.

Many other theories as to the origin of this condition are presented in the literature, and it must be assumed that the cause of branchial cysts and sinuses is as yet not settled. This condition is usually found in the younger age-groups and predominates in females.

Branchial fistulas are generally classified into three types: (1) complete fistulas, having both an internal and an external opening; (2) incomplete fistulas, having either an internal opening alone and classified as incomplete internal fistulas; and (3) fistulas with an external opening alone and classified as incomplete external fistulas.

The usual symptoms that are attributed to branchial cysts and sinuses are a tumor of the neck, a sinus with an intermittent or continuous discharge of secretion, and recurrent attacks of inflammation. Occasionally, an unexplained cough may be due to a tract which adheres to the vagus nerve.

Many conditions which commonly occur in the neck must be considered in the differential diagnosis. Among these are the following: (1) dermoid cysts; (2) cystic hygromas; (3) lipomas; (4) thyroglossal cysts and sinuses; (5) tuberculous adenitis and sinuses; (6) venous hemangiomas; (7) deep cervical

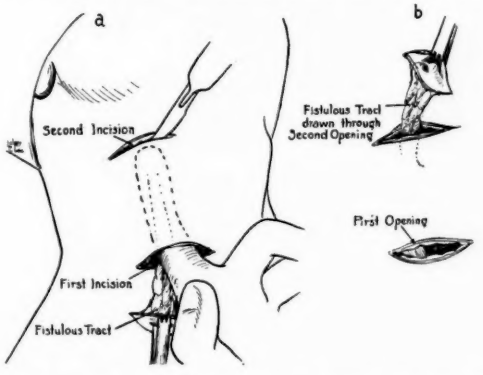

Fig. 1. The stepladder method of surgical excision of branchiogenic cysts and sinuses. A transverse elliptical incision is first made around the external opening, and the sinus tract dissected upward along the sternomastoid muscles. Care must be taken of the great vessels. A second transverse incision is then made at a higher level in the neck parallel with the first, and the dissected branchial fistula is then brought out through this second incision.

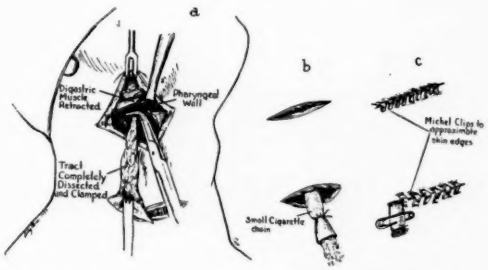

Fig. 2. The dissection is then carried posteriorly to the wall of the pharynx where the tract is sectioned. The authors do not believe that inversion of the fistulous tract into the pharynx is necessary. The hypoglossal nerve is commonly seen in this part of the dissection and must be avoided. The wounds are closed about a small rubber-dam drain. (Courtesy of J. B. Lippincott Co.)

abscesses; (8) actinomycosis; (9) Hodgkin's disease; (10) lymphosarcoma; (11) lymphatic leucemia; (12) carotid-body tumors; and (13) various cervical metastatic neoplasms.

A diagnosis of branchial cyst or sinus can, therefore, be established ordinarily by remembering that it will be found in the neck anterior to the sternomastoid muscles, from the angle of the jaw to just above the clavicles; it is of a congenital nature, and does not present any specific condition mentioned.

The treatment of branchial fistula by the injection of sclerosing solutions is not recommended because of the danger of perforation of the pharynx by necrosis and the marked inflammatory reaction which may result.

A majority of surgeons advocate complete excision of the sinus tract or cyst and suggest various methods. Beck has advocated the use of a collar incision for this procedure, such as is employed in operations on the thyroid. Von Hoeker suggests the insertion of a probe into the tract with fixation of the tract to the probe by a ligature, which he believes facilitates removal. Baumgartner emphasizes the importance of inverting the stump of the fistula into the cavity of the pharynx whenever possible. Gaston, reporting a series of 29 cases from the Cleveland Clinic, does not believe that the inversion of the stump of the fistula into the cavity of the pharynx is necessary, although he agrees that complete surgical extirpation of the tract is essential.

Bailey uses the so-called stepladder method of surgical excision, and this operation has been utilized in the majority of the authors' cases (Figs. 1 and 2). A transverse incision is first made about the external orifice. The skin is freed-up, gentle traction is then exerted on the fistulous tract, and the dissection carried up around the tract as far as possible. At this point, a second transverse incision is made parallel with the first, at a higher level, and the tract is brought up from the first incision out through the second higher incision. This allows an adequate exposure during the dissection of the tract up to the wall of the pharynx, which is essential.

At times, it may be of assistance to place one finger inside of the mouth and apply pressure against the pharyngeal wall so that danger of perforation of the pharyngeal wall can be minimized. The authors do not think that inversion of the fistula into the pharynx is necessary and have never done it.

At the Lahey Clinic, follow-up studies have been made in 27 cases occurring during the last ten years. In all cases complete surgical excision was performed. Recurrence has not taken place in any of the cases. SAMUEL H. KLEIN, M.D.

Farjat, F. P.: Thyroid Perichondritis with Descending Abscess of the Neck and Mediastinitis (Pericondritis tiroidea con absceso de cuello descendente y mediastinitis). *Rev. oto-neuro-oftalmol. y de cirug. neurol. sud-americana*, 1941, 16: 24.

Farjat states that inflammation of the perichondrium of the laryngeal cartilages generally results in the formation of a pus collection between the membrane and the cartilage with subsequent necrosis of the latter because of lack of nutrition. This necrosis may be localized or diffuse. Perichondritis rarely causes hyperplastic thickening of the perichondrium. The process may be primary or secondary. The primary process occurs as a sole manifestation in the larynx: the lesion appears directly in the perichondrium and may spread from there: an idiopathic form and a metastatic form are accepted, the latter being the most common and resulting from a process which is or has been present in the organism (smallpox, grippe, pneumonia, puerperal infection). The secondary process is due to propagation by continuity of a generally ulcerous process of the larynx itself or of its vicinity (tuberculosis, syphilis, tumor, typhoid, smallpox, scarlet fever): it may be caused by trauma or by continuous pressure of a cannula.

The picture will differ with the cartilage involved. Necrosis of the cartilage occurs more easily in hyaline than in elastic cartilage because the latter contains intrinsic glands which insure its nutrition, as in the epiglottis. While the abscess forms, the perichondrium offers marked resistance to perforation, but usually gives way somewhat and a pus pocket appears. In view of the various more or less resistant layers of tissue which cover the larynx, it is evident that the possibilities of spontaneous opening of the abscess toward the outside are remote; in addition, the habit of waiting for fluctuation before opening the abscess is another unfavorable factor, and there comes a time when the pus follows the route of lesser resistance and works its way down toward the mediastinum. The other dangers of prolonged waiting are asphyxia, ulceration of the large vessels, and thrombophlebitis of the internal jugular vein.

The author reports 2 cases of perichondritis of the thyroid cartilage in which the abscess reached into the mediastinum. The first case occurred after grippe and required two interventions with an interval of fifteen days; the second case occurred in connection with an attack of pneumonia.

RICHARD KEMEL, M.D.

Kaspar, F.: The Treatment of Postoperative Reactions of Patients with Basedow's Disease (Zur Behandlung der postoperativen Reaktionen des Basedowkranken). *Deutsche Ztschr. f. Chir.*, 1940, 254: 227.

Up to the present time the best prophylactic remedy for the dreaded postoperative reactions of the patient operated upon for Basedow's disease is the Plummer procedure, but this is applicable only in true cases of fully developed Basedow's disease and must be avoided in all other thyrotoxicoses. Even though only 5 per cent of the patients with Basedow's disease do not respond to the Lugol solution, the most severe reactions are not eliminated even when a favorable effect is produced by this remedy.

The author reports on 287 operations for exophthalmic goiter among 4,384 strumectomies per-

formed during the period from 1937 to 1939. Among these there were a number of Lugol-refractory and Lugol-hypersensitive patients, who nevertheless had to be operated upon. In some of these cases blood letting with subsequent sodium-chloride infusions proved valuable. Furthermore, in 14 cases, of which 3 are described in detail, with a severe postoperative state, calcium was administered intravenously in the form of afenil and calcium-Sandoz and kalzan was given intramuscularly, as a result of which the markedly accelerated pulse and the increased body heat were soon reduced. The effect appears as a dampening of the sympathetic hyperexcitability, which may well be a significant partial cause of the danger of the postoperative Basedow's disease. It is certain that in Basedow's disease, even though the blood calcium level be practically normal, there is an increased excretion of calcium, on the one hand in the intestine for the fixation there of the massively excreted soaps with diarrheas, and on the other hand because of the latent osteodystrophia fibrosa demonstrated in this condition, and this must naturally express itself in an increased excitability of the sympathetic nervous system, when as a result of the resection of the thyroid gland the calcium metabolism sinks still more markedly for several days. In these cases the forced administration of calcium, which is intended not as a substitute for the Plummer procedure but only as a substitute in the latter's failure, can have its most advantageous effect.

(Max Budde). Louis Neuwelt, M.D.

Rasmussen, H.: Influence of the Thyroid Hormone on the Heart and Circulation. *Acta med. Scand.*, 1941, Supp. 115.

Treatment with thyroid hormone was carried out in 12 dogs in experiments lasting from 28 to 272 days, the object being to bring about death of the animal by this treatment. Parke-Davis desiccated thyroid was used. The dose, by weight, in individual dogs varied considerably, as it ranged from ¾ gm. per kilo to 1½ gm. per kilo. This proportion resulted in a daily dose of from 80 to 225 gr. of thyroid a day. The individual animals survived 28, 36, 46, 51, 63, 68, 72, 83, 94, 95, 116, and 157 days. The survival time is tabulated with the grams per kilo of the daily dose:

28 days	0.88 grams per kilo
36 days	1.00 grams per kilo
46 days	1.10 grams per kilo
51 days	1.08 grams per kilo
63 days	0.76 grams per kilo
68 days	0.83 grams per kilo
72 days	1.47 grams per kilo
83 days	0.86 grams per kilo
94 days	0.80 grams per kilo
95 days	0.78 grams per kilo
116 days	0.76 grams per kilo
157 days	0.84 grams per kilo

These figures show that the resistance to this intoxication was not correlated with the dosage. The dog which lived longest lived five times as long as the one which died soonest, and yet this long survivor received a smaller dose. Nor was the survival dependent upon the age or the original weight of the animal. There is no correlation between the length of survival and the elevation of the metabolic rate: in fact, the animal that lived longest sustained the highest rate and, as might be expected, lost the greatest percentage of its body weight. One gains the impression that the animals that succumbed most rapidly developed an excessive tachycardia in proportion to the elevation of the metabolism.

The authors summarize their findings as follows:

"Long-continued treatment with thyroid hormone, partly through feeding with desiccated thyroid substance, partly through intravenous injection of thyroxine, was carried out on dogs in order to obtain as complete a picture as possible of the changes produced by the hormone in heart and circulation, as well as to investigate whether these cardiovascular changes are due to increased oxygen transport and, lastly, to study the possibility of bringing about functional or organic disorders of the heart or circulation by means of the treatment."

Their principal findings are:

"1. During constant and vigorous hormonal action with, for instance, 100 per cent increase in oxygen consumption, the heart may be found to vary greatly, from subnormal or normal to extreme rapidity, these variations being observed in one and the same animal. The most characteristic effect of the hormonal influence is not a tachycardia of constant intensity but the paroxysmal rises in heart rate, up to 250 or 300 beats per minute with regular action and retained sinus rhythm.

"2. The systolic blood pressure is augmented and shows a tendency to progressive rise throughout the period of treatment. The diastolic pressure seems to be practically unaltered.

"3. The regulation of the increased heat production is effected mainly by a simultaneous increase of body and skin temperature. A mechanism of heat regulation by help of increased blood flow to the peripheral skin organ does not seem to come into play to any considerable extent.

"4. The arteriovenous oxygen difference is unaltered and the cardiac output increases proportionally with the oxygen consumption. The stroke volume of the heart may be considerably augmented during slow cardiac action, while in violent paroxysms of tachycardia it is considerably reduced.

"5. The electrocardiogram exhibits characteristic but often transient changes, the T-waves in one or most often in all three leads assuming a characteristic appearance with deep negativities. In a later stage the T-waves acquire a peculiar "two-humped" appearance. Increase in duration of the QT interval is a fairly constant phenomenon. No satisfactory explanation can be given of the thyroid electrocardiogram.

"6. The hormone-treated dogs die in a typical state of circulatory insufficiency, which is always inaugurated by and accompanied by attacks of

tachycardia. The terminal circulatory failure is thus primarily characterized by intense tachycardia and further by first normal, afterwards decreasing systolic and diastolic blood pressure, diminishing cardiac output, materially augmented arteriovenous difference and a considerable reduction of the stroke volume."

Their principal conclusions are:

"1. The essential feature in the action of the thyroid hormone on the heart rate during rest is not increase of, but variability of heart rate. The power of evoking paroxysms of sinus tachycardia is a peculiar and characteristic property of the thyroid hormone.

"2. The hormonal tachycardia is not due to the extra work imposed upon the circulatory system owing to the increase in oxygen consumption occasioned by the hormone.

"3. The tachycardia crises, when particularly intense and protracted, give rise to circulatory failure which finally leads to the death of the animal.

"4. Thus the thyroid hormone evokes a functional heart disease, of which the essential feature is paroxysms of tachycardia and which brings about a fatal cardiac failure.

"5. The principal deleterious effect of the thyroid hormone on the heart and circulation is not the creation of extra work for the heart owing to increased oxygen transport, but the influence it exerts on the cardiac rhythm.

"6. Far from being a mechanism of circulatory adjustment, the tachycardia evoked by the thyroid hormone is a factor detrimental to the heart and the circulatory system." PAUL STARR, M.D.

Kelly, J. D.: Surgical Treatment of Bilateral Paralysis of the Abductor Muscles. *Arch. Otolaryngol.*, 1941, 33: 293.

Kelly attempts to answer the question: "What can I do to relieve the patient suffering with bilateral paralysis of the abductor muscles, and what results can I expect?" It is his belief that not all patients with bilateral paralysis of the abductor muscles need immediate operation. A patient (whatever the cause of his paralysis) with the cords in the cadaveric position, with a good voice, and with no dyspnea on ordinary exertion may be watched until he seeks relief. Such a patient whether he is in confinement or in circumstances requiring excessive physical strain, should be tracheotomized and operated upon for paralysis of the abductor muscles at his convenience and that of the physician. From his study and experience, the author believes it is wise to wait from six months to one year before operating unless it is definitely known that the nerves have been cut, because there have been reports of restoration of function after a lapse of eighteen months.

The author believes that the surgical data gathered through his extensive questionnaire prove without doubt that the greatest success in the treatment of bilateral paralysis of the abductor muscles is attained by those operations in which the arytenoid cartilage is attached either extralaryngeally or intralaryngeally. In view of the number of successful operations reported by King, it seems imperative that the King operation should be tried before any other extralaryngeal procedure. Arytenoidectomy, either through the King incision or through the wing of the thyroid cartilage, should be tried on one or both sides before resort to an intralaryngeal operation. If the external operations on the arytenoid cartilages fail, intralaryngeal surgical procedure is in order. Resection of the thyro-arytenoideus and the crico-arytenoideus lateralis muscles, according to the method of Loré or Rawlins, is preferred.

If the laryngologist follows this sequence in the surgical treatment of bilateral paralysis of the abductor muscles, he will make no uncertain moves: he will never do more than is necessary to give the patient a satisfactory result, and he will most thoroughly conserve the interest of the patient.

NOAH D. FABRICANT, M.D.

Jackson, C. L.: Laryngofissure for Cancer of the Larynx; Observations Based on a Series of 50 Consecutive Cases. *Arch. Otolaryngol.*, 1941, 33: 520.

The author bases this article on 50 cases of carcinoma of the larynx which were treated by the operation of laryngofissure. All patients were operated upon under local anesthesia with 1 per cent procaine hydrochloride injected subcutaneously. The results obtained are as follows:

There was no operative mortality, but 6 patients died later of causes other than cancer, 3 of them having survived for three years, 1 for two years and 2 for a little over one year. In only 5 patients in the series have recurrences developed, and on 3 of these laryngectomy was subsequently done; 1 died of complications following the laryngectomy and the 2 others are still well, eight years and eight months after laryngectomy, or ten years and one and a half years, respectively, after the original operation. One has just had a second laryngofissure and may be given postoperative irradiation. Subtracting the last 4 patients, who were operated upon less than a year ago and were all free of any sign of recurrence, but who were operated upon too recently to count, there remain a series of 46 patients, in only 4 of whom recurrences have developed. Therefore 91 per cent of the patients were well and free of recurrence for periods of one year and longer, the patients who have been well for eight years and eight months, respectively, after laryngectomy not being counted as cured. Ten patients have survived, cancer-free, for five years and more, 3 for four years, 13 for three years, 5 for two years, and 11 for between one and two years. Since it is generally agreed that little significance can be attached to statistics recording cures of less than three years' duration, one may add the first three groups together. This gives 26 of 30 patients treated by laryngofissure more than three years ago, who are living and free of recurrence for at least three years, an incidence of cures of 86.6 per cent.

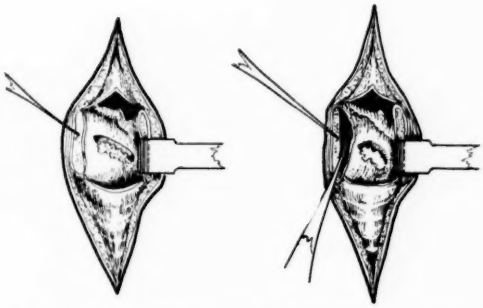

Fig. 1. Schematic representation of laryngofissure by the clipping technique. Note the elevation of the internal perichondrium from the inner surface of the thyroid ala (Jackson and Jackson).

Hemorrhage, if it occurs, generally occurs within the first twelve hours. It was observed in only 2 of the cases in this series.

Granulomas form in about 35 per cent of the cases. Sometimes they shrink and disappear in a few weeks. They should be given a chance to do that, and if they do not disappear they should be removed by direct laryngoscopy, for their presence, even though not obstructive to an important degree, will interfere with the development of the voice.

Abscess, perichondritis, and chondral necrosis occur in certain cases and require free drainage.

Bronchopneumonia occurred in only 1 case of the series.

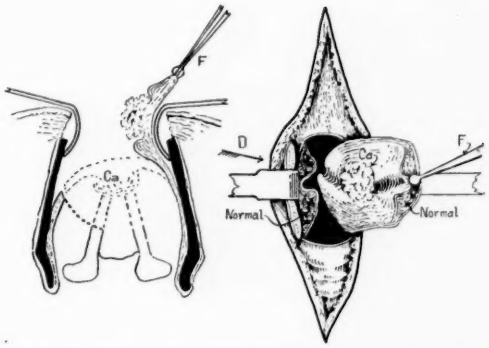

Fig. 2. Schematic representation of laryngofissure by the anterior commissure technique. Note that soft tissues are cut first on the less involved side and that the flap is then reflected in such a way as to permit inspection of the lesion before the excision is completed (Jackson and Jackson).

Cure of the cancer is, of course, the primary consideration, but next comes the question of voice. All the patients in the series reported were able to talk, but the quality of voice and its carrying power varied greatly. In some patients the postoperative voice was produced at the cordal level by a remaining good cord approximating with a cicatricial cord or by two cicatricial cords. In other cases it was produced by approximation and vibration of the ventricular bands.

JOHN F. DELPH, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

McIntyre, A. K.: The Physiology of the Cerebellum. *Med. J. Australia,* 1941, 1: 167.

Three methods have been employed in the investigation of cerebellar function: namely, ablation experiments, stimulation experiments, and action-current studies. Since the boundaries of the various portions of the cerebellum do not have definite anatomical landmarks, it is best to consider this organ from a functional point of view, and use the phylogenetic classification of "neocerebellum" and "paleocerebellum."

So far as the functions of the paleocerebellum are concerned, the vestibular portion, consisting of the flocculonodular lobe, the uvula, and the lingula, and the associated portions of the fastigial nuclei with their medullary projections are actually extramedullary extensions of the vestibular nuclei, and they mediate similar functions. They are necessary for the co-ordination of labyrinthine impulses with muscular movement in the intact animal, but they play no part in the primitive labyrinthine reflexes of the decerebrate animal. The remainder of the paleocerebellum is mostly concerned with the restraint of excessive activity of the postural reflexes. It produces appropriate changes in the postural pattern according to the requirements of muscular movement when such is signaled by the spinocerebellar and bulbocerebellar tracts. In addition, it seems that the pyramis may be concerned with the ability to judge distances by integrating proprioceptive impulses from the eye muscles.

The neocerebellum, not of importance in the lower mammals, is essential in primates for the maintenance of muscle tone and the proper execution of skilled muscle movement. The dentate nucleus can exert enough control over voluntary movements to prevent the development of tremor and to hasten the process of recovery from cortical ablation. Disturbances of equilibrium and posture, except those due to hypotonia, are not produced by neocerebellar injury. There is apparently no discrete representation of the skeletal musculature in the cerebellum.

JOHN MARTIN, M.D.

Denny-Brown, D.: Delayed Collapse after Head Injury; Case Records. *Lancet,* 1941, 240: 371.

Among many other casualties of the present European war, the author has observed a number of patients who, after suffering what would seem to be a minor head injury, showed signs of a "delayed collapse" from several hours to a few days following the accident.

The cardinal signs of such a sudden collapse, usually with unconsciousness, are not those which accompany middle meningeal hemorrhage after the characteristic lucid interval. A common and characteristic disturbance which fails to develop into anything more than a transient complaint is a marked bradycardia, sometimes as low as 38 or 40, with weakness, vertigo, and a dull mental state. This condition is not to be classed simply as cerebral concussion, for it does not present all the signs of so-called concussion; it clears up completely and fairly rapidly on rest and quiet, and, above all, it is not related to an increase of intracranial pressure.

The medulla appears to be the only region where injury is likely to produce such persistent slowness of the pulse, bloody cerebrospinal fluid, and no sign of greatly increased intracranial pressure. Bruising of the medulla has actually been demonstrated in such cases, and when the injury is not severe enough to cause respiratory or other paralysis, the patient will suffer mainly from weakness and bradycardia, his hemorrhages being of pin-point size in the pia of the surface or in the floor or roof of the fourth ventricle. Even a few such hemorrhages, critically placed, could account for vagal disturbances and vasomotor instability.

Six interesting and illustrative case histories are reviewed.

JOHN MARTIN, M.D.

Russell, D. S., and Falconer, M. A.: Antiseptics in Brain Wounds; An Experimental Study of the Histological Reaction of Cerebral Tissues to Various Antiseptic Solutions. *Brit. J. Surg.,* 1941, 28: 472.

Cerebral traumatic wounds have a strong tendency to become easily infected, and they are thoroughly cleansed at surgery only with great risk of either causing great brain damage or, even after meticulous attention, leaving some remaining nidus of infection. Antiseptics are not commonly used in the brain because of the delicate nature of cerebral tissue. The authors have undertaken the task of determining which, if any, surgical antiseptics, the germicidal potency of which is agreed upon, can be applied to the brain in such a way as to harm the tissues less than would the bacteria.

They point out that in the brain as in the other tissues of the body, the topical application of antiseptics in old established foci of infection is very ineffective compared to the results of such application in fresh wounds, because of the location of the bacteria.

The ideal antiseptic for recent or potential infection of the brain should possess three properties: (1) it should be a potent bactericidal agent *in vivo* as well as *in vitro;* (2) it should be innocuous to the tissues locally; and (3) it should be harmless to the organism as a whole after absorption.

In their experimental studies the brains of adult rabbits were used, with proper controls. The materials used and the results obtained are shown in

SUMMARY OF EXPERIMENTS

TABLE I.—CONTROLS

Solution	pH	No. of experiments	Degree of reaction in brain
Isotonic buffered saline	7.4	5	Very slight
Isotonic saline	7.0	4	Very slight
Isotonic saline	2.2	2	Slight
Isotonic saline	10.0	3	Slight
Distilled water	7.0	7	Considerable

TABLE II.—ANTISEPTICS TESTED

Antiseptic	Solution	pH	No. of experiments	Degree of reaction in brain
1. Acridine compounds:				
Acriflavine	0.1% in distilled water	2.0	9	Severe
	0.1% in isotonic saline	2.0	2	Severe
	0.1% in buffered isotonic saline	7.2	2	Severe
Euflavine	0.1% in buffered isotonic saline	7.2	3	Severe
	0.05% in buffered isotonic saline	7.4	2	Severe
Proflavine	0.1% in buffered isotonic saline	6.2	8	Very slight
2 : 7 diamino-acridine	0.1% in buffered isotonic saline	6.2	2	Slight
2. Coal-tar derivatives:				
Dettol	5.0% in distilled water	12.0	5	Severe
	5.0% in buffered isotonic saline	7.4	3	Moderate
"Modified" dettol	5.0% in isotonic saline	8.4	2	Moderate
	5.0% in buffered isotonic saline	8.1	2	Moderate
Supersan	5.0% in buffered isotonic saline	8.2	2	Moderate
3. Halogen compounds:				
Azochloramid	0.03% in buffered isotonic saline	7.4	15	Variable
	0.2% in triacetin	4.0	3	Severe
Eusol		9.0	4	Severe
4. Organic mercurial compounds:				
Metaphen	0.1% in buffered isotonic saline	10.0	2	Considerable
	0.04% in buffered isotonic saline	10.0	2	Considerable
Merthiolate	0.1% in buffered isotonic saline	10.0	2	Considerable
	0.04% in buffered isotonic saline	10.0	2	Moderate
Phenyl mercury nitrate	0.08% in isotonic saline	10.0	2	Considerable
	0.04% in isotonic saline	10.0	2	Moderate
5. Hydrogen peroxide	3.0% in distilled water	4.0	2	Moderate
	3.0% in buffered isotonic saline	7.4	3	Moderate
6. Soluseptasine	3.3% in isotonic saline	10.0	2	Slight
	3.3% in buffered isotonic saline	7.4	2	Slight

the accompanying chart, taken from the article. Interestingly enough, hydrogen peroxide, used in many clinics in America for the control of hemorrhage and the surgical toilet of wounds, was found to be rather extensively damaging to the tissues encountered by it. Also variations in the pH of a solution, from as much as 2 up to 10, caused surprisingly little additional damage, and osmotic imbalance, as gross hypotonicity, caused a much more extensive necrosis and hemorrhagic breakdown in the brain than erratic pH levels. Therefore, isotonic solutions buffered as far as possible to the neutral point are ideal for brain use. Proflavine sulfate in 0.1 per cent isotonic solution buffered to a pH of 6.2 is probably the antiseptic to be preferred in the prophylactic treatment of brain wounds; 2:7-diamino-acridine hydrochloride is similar in its action to proflavine. There is reason to believe that some of the soluble sulfanilamide compounds, effective locally elsewhere in the body, may be used with safety and usefulness in the brain.

JOHN MARTIN, M.D.

Latham, O.: Some Notes on the Pathology of the Cerebellar System. *Med. J. Australia*, 1941, 1: 164.

Cerebellar pathology is admittedly difficult and elusive of good classification. The author roughly classifies cerebellar disease into 5 groups.

1. Primary parenchymatous degeneration (chronic progressive degeneration of the Purkinje cells) may possibly resemble Pick's type of atrophy in the cerebrum, or, considering an early aging of the Purkinje cells, a sort of Alzheimer's disease of the cerebellum may be supposed.

2. Obvious developmental defects, such as a congenitally small or cystic hemisphere, will usually be found in idiots.

3. Vascular lesions, small and interstitial, may follow typhus and influenzal fevers, and result in localized necrosis. Thrombosis of the venous sinuses will cause rapid cortical and nuclear change, and thrombosis of the superior cerebellar artery may produce a lesion as deep as the dentate nucleus.

4. Cerebellar degeneration, as evidenced by glial reaction, may follow infective states such as tuberculosis, various types of encephalitis, syphilis, chicken pox, malaria, torula, rabies, and abscess.

5. Tumors, such as gliomas of various types, secondary metastases, sarcomas, meningiomas, acoustic neurinomas, and various vascular tumors, are commonly recognized causes of cerebellar dysfunction and pathology.

Special technical procedures for the study of cerebellar tissue are described. JOHN MARTIN, M.D.

Dandy, W. E., and Follis, R. H., Jr.: Carotid-Cavernous Aneurysms. *Am. J. Ophth.*, 1941, 24: 365.

Two cases of carotid-cavernous aneurysms are reported in this article. They are presented principally from the pathological point of view and apparently do not differ in many respects from other carotid-cavernous aneurysms that have been described elsewhere in the literature.

The article contains a very clear and complete description of the post-mortem specimen in both cases. The first case was unusual in that the exophthalmos and the pulsation were not on the same side as the fistula. The diagnosis was established by the bruit, which was stopped by compression of the internal carotid artery in the neck. In both cases fascial bands were placed around the internal carotid artery as a preliminary step to the operation.

In the first case a further attempt was made to put a clip on the internal carotid artery within the cranial cavity. This proved to be unsuccessful. The exophthalmos was on the opposite side from the fistula because of thrombosis of the left ophthalmic vein.

The authors point out the necessity of compressing the internal carotid artery in the neck as a preliminary procedure, and advocate a period of five or ten minutes for such compression. In many clinics it is thought necessary to compress the common carotid artery for a longer time.

The second case was also noteworthy because of the fact that the exophthalmos appeared twenty-four days after an accident; the first of these cases was non-traumatic.

Ocular palsies have long been recognized as accompaniments of these conditions, and in both of the cases reported there was palsy of the third nerve. Loss of vision also occurred, probably because of pressure forward of the sac and the cavernous sinus on the optic nerve.

The portions of this article which deal with the examination and study of the post-mortem specimens is extremely complete. To those physicians who are interested in the vascular system, this article should be a matter of considerable interest.

ADRIEN VERBRUGGHEN, M.D.

Quinland, W. S.: Tuberculoma of the Cerebrum; Report of a Case. *J. Nat. M. Ass.*, 1941, 33: 75.

Though cerebral tuberculomas are not common, neither do they surprise pathologists. However, when their presence creates symptoms which lead to a false diagnosis, then an analysis of even a single case history becomes important.

A cerebral tuberculoma in a forty-four-year-old negro man is reported. Convulsive seizures, hemianesthesia, reflex changes, and evidence of increased intracranial pressure led to a diagnosis of a cerebral neoplasm, but because of a 4 plus Wassermann reaction in the blood, cerebral gumma was suspected and operation was deferred in favor of anti-luetic medical treatment. The patient died and at autopsy a well circumscribed, typical, large tuberculoma, 5 by 4 by 3.5 cm. in size, was found in the right cerebral hemisphere, involving the postrolandic convolution.

It is pointed out, with this case as an object lesson, that a correct clinical diagnosis of tuberculoma of the brain is difficult when quiescent tuberculosis (as in the patient reported) exists elsewhere in the body, and that the presence of syphilis adds greatly to the difficulty. Operative removal of a tuberculoma of the brain may result in immediate or delayed death from tuberculous meningitis. JOHN MARTIN, M.D.

Sorgo, W.: The Results of Surgical Treatment of Brain Tumors (Ueber die Ergebnisse chirurgischer Behandlung bei intracerebralen Tumoren). *Muenchen. med. Wchnschr.*, 1940, 2: 1168.

A study of the more important statistics on brain tumor (including about 6,000 cases classified histologically according to uniform points of view) has shown that one-half of all brain tumors are gliomas. Another group of tumors are of intracerebral or intraventricular localization but do not spring from the brain tissue itself; however, because of their position, a surgical approach through the brain is imperative. Individually the results of treatment may be expected to be as follows:

Prognosis in astrocytoma varies according to whether the tumor is cerebral or cerebellar. When the latter, it has a splendid prognosis because it does not break through the pial septa of the individual cerebellar lobes. The prospects are different in astrocytoma of the cerebrum. Fibrillary astrocytomas are circumscribed and therefore have a good prognosis; this applies also to astroblastomas. Protoplasmatic astrocytomas extend by infiltration

and, therefore, it is difficult to distinguish them. Recurrence cannot be prevented. Gliosarcoma, recently designated as glioblastoma multiforme, is wholly malignant. Prognosis is poor also in medulloblastoma, although a few cases have been reported in which the patients have survived for years. The spongioblastomas, which are in themselves benign tumors, may be located in the chiasma or third ventricle where they are inaccessible. The author contradicts himself somewhat, however, in stating that these tumors behave like protoplasmatic astrocytomas. In considering the oligodendroglioma one has to reckon with two types, one with a tendency toward calcification, and which is readily removed with good end results; and another type characterized by the formation of mucus and a tendency toward infiltrative growth. The tumors of the ganglion-cell series are benign, slowly growing tumors, but they are located in the brain stem, medulla oblongata, and cornua of Ammon, and therefore are frequently inaccessible.

Tumors of the pineal gland (pinealomas) are not encapsulated but are usually infiltrative. They are most difficult to remove. Angiomas have frequently been removed successfully. Indications for operation are determined by arteriography demonstrating the type and site of the blood supply. The Lindau tumors, which are located exclusively in the cerebellum also belong to this group. Radical removal offers a very good prognosis. The diagnosis and removal of abscesses are difficult. The results of surgical treatment are markedly dependent upon the pre-operative diagnosis.

The author discusses briefly the advantages of arteriography. Roentgen irradiation has given no positive results, only transitory results in medulloblastoma. The only means of helping the patient is by surgical intervention. According to the results obtained in the First Surgical University-Clinic of Vienna, a three-year survival may be expected in from 43 to 45 per cent of cases. Most of the recurrences take place within the first three years. Excellent tables permit a survey of this fine collective review. (Vogeler). Edith Schanche Moore.

Romano, N., and Eyherabide, R. A.: Some Neurological Pictures Due to Metastasis of Pulmonary Cancer (Algunos cuadros neurológicos por metastasis de cáncer pulmonar). *Rev. méd. d. Rosario*, 1941, 31: 1.

The authors state that the metastases of many cases of pulmonary cancer present obtrusive symptoms contrasting with the modest bronchopulmonary symptoms and that this inconsistency must be kept in mind to avoid regrettable errors in treatment. Among their cases of metastatic cancer due to primary blastoma of the lungs, they have selected some observations in the field of neurology to show the caution that must be used in establishing the diagnosis of primary cerebral tumor in spite of the fact that the cerebral metastasis is the only clinical manifestation. Metastases may occur in any part of the brain, but show a predilection for the cerebral hemispheres, as only two cerebellar localizations were found among 10 observations. The metastatic nodules were single in 2 cases and multiple and differing in size, number, and distribution in the other cases. All were of epithelial nature, but their macroscopic characteristics varied in a few cases. Fried explains the frequency of cerebral metastasis by stating that the cancer cells of the lung can reach the central nervous system by way of the blood stream without encountering any obstacles, while those of any other part of the body are arrested in their migration by the pulmonary filter. The bronchopulmonary process was easily recognized by clinical examination in some cases; it was a roentgen finding in 1 case, an autopsy finding in 2 cases, and detectable by careful investigation in the remaining cases. Four of the cases are described.

The first patient presented a typical cerebellar syndrome and a pulmonary condensation syndrome of the upper third of the lungs; roentgen examination showed a dense shadow occupying the upper half of the right lung, but bronchography was impossible because of vomiting at the slightest maneuver; secondary cerebellar localization of a primary neoplasm of the upper right bronchus was suspected and later confirmed at autopsy.

The second patient presented a neurological syndrome of cortical irritation and a bronchopulmonary respiratory syndrome; roentgen examination revealed on the right side: pulmonary atelectasis, narrowing of the intercostal spaces, elevation of the hemidiaphragm, mediastinal retraction to the same side, and opacity of the upper third of the lung; subsequent roentgen examinations confirmed the suspicion of pulmonary tumor and autopsy later showed a tumor of the upper right lobe and metastases to the first and second left temporal and right frontal convolutions.

The third patient presented spastic hemiplegia on the left side with intense pyramidalism, clonus of the foot, the Babinski sign, inexpressive facies, parkinsonian aspect, amnesia, and mental obnubilation; there were some râles in the lungs; roentgen examination revealed only some reactional signs in the pulmonary parenchyma, but the cardiovascular shadow was displaced to the left, and the left side of the thorax was retracted. Autopsy gave the key to the puzzle by revealing a small endobronchial tumor, which did not obstruct completely the lumen of the bronchus, and a metastatic tumor of the size of a mandarine in the frontal pole of the right cerebral hemisphere with edematous and necrotic peritumoral zones.

The fourth patient presented a right hemiplegia, headaches and symptoms of cerebral hypertension, and signs of induration of the right upper pulmonary lobe; roentgen examination revealed an atelectatic shadow of this lobe, but further investigation was prevented by the condition of the patient. The diagnosis of pulmonary cancer with probable cerebral metastasis was made and later confirmed by

autopsy: an epitheliomatous tumor was found in the right upper bronchus with atelectasis of the corresponding lobe, while the lower part of the upper parietal convolution showed a tumor of the size of a quarter; there was also a cystic dilatation of the pineal body.

The 6 other cases were similar to those described. The cerebral tumors presented no predilection for certain zones.

These cases show the importance of a careful examination of the respiratory apparatus.

RICHARD KEMEL, M.D.

MISCELLANEOUS

Denk, W.: The Surgical Management of Hypertension (Ueber die chirurgische Behandlung der Hypertonie). *Wien. klin. Wchnschr.*, 1940, 2: 827.

The author discusses the need of operation for hypertension. He states that whereas in Italy, America, and France many operations have been done, in Germany there was considerable restraint until Vollhard and Nonnenbruch recognized the indications for certain cases. These are that the patient be relatively young with severe symptoms, eyeground changes, and an elevated pressure that is not fixed. Unfortunately the nature of hypertension is not yet clear. The question involves discrimination between essential hypertension, benign and malignant sclerosis, and white and red hypertension. For example, under essential hypertension Nonnenbruch recognizes only the benign sclerosis of Vollhard, or red hypertension, which, however, ordinarily first appears in the fifth or sixth decades and is compatible with good efficiency for many years. For this operative treatment is not justified. On the contrary, according to him, the early stages of malignant sclerosis, or pale hypertension, is a matter for operation. Peet has the same viewpoint. However, one cannot be certain at this time which form is present.

One thing is certain: in general only patients under fifty years of age with a blood pressure of over 200 mm. Hg should be subjected to operation. The blood pressure must not be fixed but should decrease on reclining, and especially during the night. To determine whether or not the hypertension is fixed one may employ splanchnic anesthesia, sodium amylate, or an intravenous injection of a 5 per cent solution of pemotkal. These tests alone are not altogether conclusive. The most important test is still the lowering of the pressure during sleep. In the presence of otherwise mild subjective complaints, retinal hemorrhages and edema of the retina or papilla are in themselves urgent operative indications, as well as signs of cardiac damage. Age of more than fifty years and elevation of the nitrogen retention above 75 mgm. per cent are contraindications. Most surgical procedures are based on the assumption that hypertension is related to a narrowing of the renal arterioles. The role of the suprarenal glands is as yet uncertain. Through the work of Konschagg and Kutschera of Aichbergen a relationship between the blood pressure and the suprarenal lipoids was shown to be very probable, for which reason operative attack on the suprarenal glands was justified.

Experimental work with animals led Peet to the conclusion that it is a question of sympathetic nervous disease with hyperirritability of the centers controlling vasoconstriction in the splanchnic region.

Up to this time the following operations have been employed for the relief of hypertension: (1) decapsulation and denervation of the renal pedicle; (2) attack on the suprarenal glands; and (3) attack on the sympathetic system. The latter is the most common method. In his more recent work Nonnenbruch again recommends the first method for early cases. Denk comments on how difficult it is for a surgeon to decide on a certain operation for a patient when the ultimate problems involved are as yet unsolved. All three types of operation attack the sympathetic nerves. Pende recommends a subdiaphragmatic sympathetic section on the left side, and in cases of failure adds a section of both splanchnics on the right side. Adson-Craig do a two-stage bilateral resection of the splanchnics major and minor, a part of the celiac ganglion, and the two superior ganglia of the lumbar chain. Peet does a bilateral one-stage resection of the supradiaphragmatic portion of the splanchnics and of the chain from the ninth dorsal to the diaphragm. By this means the major portion of the nerves can be resected and, above all, a preganglionic interruption be established, whereby the adrenalin sensitivity of the vessels, which continues after postganglionic section, is eliminated.

Whether or not these experimental results can be substantiated through clinical observation following the different methods (supradiaphragmatic or subdiaphragmatic) is as yet undecided. Pende has reported more than 500 operations by his method performed by Italian surgeons and has spoken of very great results (no statement of figures is given). The Craig-Adson subdiaphragmatic splanchnic resection has been carried out in more than 500 cases. Among these cases 47 per cent showed improvement; the mortality was very small. Among the 300 cases operated upon by Allen Adson (at the Mayo Clinic) none terminated fatally. In 1,245 cases an accurate check could be carried out. The blood pressure was good in 24 per cent and improved in 28 per cent; in 38 per cent it showed only passing improvement; and in 20 per cent the operation was a failure. Of the patients in whom the blood pressure was lowered, 80 per cent lost their nervous complaints and all their headaches. The eyeground changes disappeared only in some. The degree of the sclerosis of the optic vessels is, according to them, a direct index of the outcome. If no sclerosis was present, the results were good or moderate in 83 per cent; with sclerosis Grade I, in 52 per cent; with sclerosis Grade II, in 53 per cent; and with sclerosis Grade III, in 22 per cent of the cases.

Denk presents his own cases in a special table; these were also operated upon according to Adson

and Craig. They are also included in the collected statistics. Nine cases are presented. Three of the patients died with advanced malignant nephrosclerosis and very marked eyeground changes after from two to seven months. Three were significantly benefited and able to work; 1 showed passing improvement and died by suicide; 1 showed essential improvement but remained unfit for work; and 1 is still under treatment. The period of observation was long, from two to eight years.

Denk then presents Peet's statistics with his supradiaphragmatic splanchnic resection in 375 cases. The observation period was from six months to five years. Subjective freedom from complaints was obtained in 76 per cent; 16 per cent showed moderate improvement; 8 per cent resulted in failure. The blood pressure could be lowered at least 40/25 in 48 per cent. In 57 per cent of the patients who previously showed a decrease in renal function there was lasting improvement following operation. Lasting improvement was also shown in 76 per cent of the patients with eyeground changes. It was striking that even as in reports of other surgeons, subjective and objective improvement also occurred without a lowering of the blood pressure. Therefore Peet thinks it necessary to conclude that the elevation of the blood pressure as such is not so important, but that toxic substances are elaborated in the ischemic kidney, the production of which is diminished as a result of the improved circulation. Consequently, the supradiaphragmatic resection appears to be the better. Statistics can be deceiving, however. Collection of further evidence will be valuable as the surgery of hypertension is still in its developmental stage. Operation is no more difficult than denervation of the kidney pedicle, and the operative mortality is extremely small.

(Franz). John L. Lindquist, M.D.

SURGERY OF THE THORAX

TRACHEA, LUNGS, AND PLEURA

Monod, O. W. F.: Lobectomy in Case of Injury to the Hilum of the Lung; Report of 2 Cases. *J. Thoracic Surg.*, 1941, 10: 475.

The author reports 2 cases of emergency pulmonary lobectomy for gunshot wounds of the hilum of the lung. The first patient had a self-inflicted wound in the left chest. There was evidence of massive hemorrhage into the thoracic cavity. Under light chloroform anesthesia the chest was opened and the pleural cavity emptied of blood. A perforating wound of the pedicle of a free left middle lobe was found to be bleeding. A forceps was placed on the pedicle and the lobe was removed. The stump was sutured with chain catgut sutures. There was also a perforating wound through the apex of the lower lobe which had ceased to bleed. The apex of the lower lobe was removed. The wound was closed without drainage and the patient made an uneventful recovery.

The second patient suffered from two self-inflicted bullet wounds in the left chest. There was evidence of a massive hemothorax. This patient was given light chloroform anesthesia, the chest was opened through the fifth intercostal space, and the pleura was emptied of a large quantity of blood. An injury of one of the main branches of the left superior pulmonary vein was seen. A subtotal lobectomy of the left upper lobe was performed by mass ligation with silk and the chest wound was closed without drainage. During convalescence the patient developed appendicitis and an appendectomy was done. He recovered entirely.

Both of these patients reached the hospital and were on the operating table within thirty-five minutes of the injury, which probably accounts for the successful treatment. JULIAN A. MOORE, M.D.

Singer, J. J., Jones, J. C., and Tragerman, L. J.: Aseptic Pleuritis Experimentally Produced. *J. Thoracic Surg.*, 1941, 10: 251.

Thirty rabbits were injected with various substances intrapleurally, and the gross and microscopic effects were studied in detail. The authors showed that the intrapleural injection of talc, thymol iodide, and bismuth formic iodide in saline solutions produces aseptic pleuritis in most instances.

Of these various substances, talc in whatever form administered had seemed to produce the most desirable changes in the simplest fashion. The usual gross features of the pleural reaction to talc were thickening, development of band and fusion adhesions, and mediastinal fixation.

Histologically, the reaction to the talc consisted principally in the proliferation of fibroblasts and macrophages, with occasional exudation of other cells. Phagocytosis of foreign material by macrophages, the formation of aggregate giant cells containing foreign material, and the accumulation of crystals in dilated lymphatic channels contributed to the focal thickening. Adhesions between the involved pleural surfaces were formed by connective-tissue proliferation, which yielded bridges of fine collagen lined with mesothelium.

The reaction to talc, with the large particles used, differed from that which followed the use of more finely dispersed particles of silica or silicates. It was also sharply limited to the pleural cavity (unless injected elsewhere by accident), and regional lymph nodes showed slight, if any, change. There was no pathological evidence of toxic effect from talc injection.

The reaction of the pleura to bismuth formic iodide and thymol iodide was similar to, but not as effective as, that to talc.

Gomenol in cotton-seed oil produced soft adhesions which were not as firm as those produced by the injection of talc.

Iodized oil produced a slight reaction in the pleura.

The injection of beef broth, final pH 7.2, in the 2 animals produced only the slightest pleural reaction in twelve weeks.

The authors' observations have yielded some evidence that preliminary treatment of the pleura with the various substances used, particularly talc, protects the patient against the hazards of secondary surgical procedures. CHARLES BARON, M.D.

HEART AND PERICARDIUM

Mohr, H.: Late Results in a Case of Suture of the Heart with Ligation of the Descending Branch of the Left Coronary Artery (Spaetfolgen einer Herznaht mit Unterbindung des Ramus descendens der Arteria coronaria sinistra). *Zentralbl. f. Chir.*, 1941, p. 11.

Heart sutures usually give good results. Dshanelidze reported good results in 96.3 per cent of his cases; Hesse an excellent outcome in 77.3 per cent and good results in 22.7 per cent. Frey stated that in 27 cases, which were studied from six months to thirty-six years later, the results were favorable, aside from slight disturbances. The periods of observation have been, for the most part, too short. Of Dshanelidze's cases, 50 per cent had been observed only up to one year. Above all, it was assumed that the symptoms would improve with the passing of years. It is interesting that little significance appears to have been attached to the ligation of the coronary vessels, although the electrocardiogram revealed definite changes immediately after the injury, similar to those of coronary infarcts. These manifestations usually disappeared after a short time.

Mohr reports a case of stab wound of the right chamber of the heart, near its junction with the

pulmonary artery. The descending ramus of the left coronary artery had to be included in the suture rather high. The electrocardiogram several days later showed marked changes as in coronary infarct, but these entirely disappeared after four and one-half months. The man remained free from symptoms, and was able to work for four years, although at the end of three years the electrocardiogram showed, surprisingly, an old infarct of the anterior wall. Cardiac symptoms began after four years, with palpitation, dyspnea, and one attack with cramps in the arms. Examination revealed no cyanosis but there was enlargement of the heart to the right and tachycardia. The electrocardiogram showed the take-off of 5T above the base line, T was weakly negative, and R_2 and R_3 were split. These findings indicated clearly an old anterior chamber infarct. There was, therefore, a probably beginning cardiac aneurysm. (Franz). Leo M. Zimmerman, M.D.

ESOPHAGUS AND MEDIASTINUM

Kampmeier, R. H., and Jones, E.: Esophageal Obstruction Due to Gummas of the Esophagus and Diaphragm. *Am. J. M. Sc.*, 1941, 201: 539.

Syphilitic lesions of the esophagus are known to occur, but they are very rare. The authors have reported 4 cases of esophageal obstruction, 1 the result of a gumma of the esophageal wall and 3 the result of gummatous lesions of the diaphragm at the esophageal hiatus.

The symptoms are those of esophageal obstruction. The diagnosis can be made only by means of serological and roentgenological examinations plus esophagoscopy and biopsy. The therapeutic test of anti-syphilitic treatment is decisive.

Three of the 4 patients reported were cured by anti-luetic treatment plus dilatation of the esophageal strictures. One case was diagnosed as carcinoma of the esophagus and the patient died without receiving appropriate treatment.

Julian A. Moore, M.D.

MISCELLANEOUS

Phillips, F. J., Adams, W. E., and Hrdina, L. S.: Physiological Adjustment in Sublethal Reduction of Lung Capacity in Dogs. *Surgery*, 1941, 9: 25.

The authors over a period of years have been studying the effect of reduction in lung capacity in dogs following lobectomy, pneumonectomy, and the production of atelectasis by means of bronchial strictures produced with silver-nitrate solutions.

They have found that healthy dogs remain well and active after reduction of the lung volume to 15 per cent of normal provided the reduction is produced gradually. This reduction of lung volume is accompanied by a compensatory function. The remaining lung shows marked compensatory emphysema with stretching and fragmentation of the alveolar walls. Julian A. Moore, M.D.

THE SURGICAL MANAGEMENT OF DIVERTICULITIS OF THE COLON

A Five-Year Collective Review

HAROLD LAUFMAN, B.S., M.D., Chicago, Illinois

ALTHOUGH the nature and incidence of diverticula of the large intestine have been studied since Littre's description in 1700, it is only within the twentieth century that successful treatment, both medical and surgical, has been widely reported. During the last thirty years an attempt has been made to formulate principles of treatment based upon accurate physiological and pathological information. The writings of the past five years have served to evaluate previously published methods in the light of an ever-increasing amount of clinical material and more careful analysis of statistical data. Although no strikingly new developments in the treatment of diverticulitis have been described within this period, the indications for treatment of this disease and its complications have been more precisely defined and extensively published.

There is general agreement in the literature that diverticulosis is a non-surgical disease, and often an incidental finding. When one or more diverticula become inflamed, the condition known as diverticulitis is present. This may become a surgical disease, which depends upon the development of complications.

Application of surgery to the treatment of diverticulitis received its impetus largely through the work of W. J. Mayo, who, together with Wilson and Giffin in 1907, reported 5 cases in which surgical removal of a portion of colon was done for diverticulitis. The trend since that time, however, has been toward conservatism, especially in the presence of acute diverticulitis.

The incidence of diverticulosis averages about 5 per cent in persons over forty years of age, and about 6 per cent in patients presenting themselves for medical examination because of abdominal symptoms (W. J. Mayo, 73, Rankin and Brown, 83). Men are more frequently afflicted with this disease than are women, in the proportion of about 2 to 1. Although most patients are beyond forty years of age, many instances have been recorded in younger persons and even infants (Bearse, 8). The largest age group according to Brown (12), Kocour (62), and others is found in the fifth decade, while according to Cleland's series (19) in the sixth decade.

It is well known that acquired diverticula may occur in any portion of the colon or rectum, or throughout the entire colon. However, from 60 to 85 per cent are present in the sigmoid and descending colon (Dixon, Deuterman, and Weber, 28, Rankin and Brown, 83), and when complications requiring surgery supervene, they almost invariably arise in diverticula of these portions of bowel (Ochsner and Bargen, 79).

Many theories have been advanced for the etiology of diverticulosis, including old age, constipation with increased gaseous pressure within the colon, excessive fat or emaciation, disturbance of the sympathetic nerves of the colon (24), and an inherent weakness in the structure of the bowel, which is usually at the point of exit or entrance of the blood vessels (25, 33, 59, 84). Bearse (8) states that the possibility of diverticula of the colon being congenital must also be considered, since cases have been reported in young children and infants. Notwithstanding these and other conjectures, no definite proof as to the origin of diverticula has thus far been produced.

It is impossible to determine with any degree of accuracy the percentage of patients with diverticula who develop diverticulitis (12), although this has been variously estimated from clinical data to be from 10 to 20 per cent. Of 1,300 subjects in whom diverticula were found during routine gastro-intestinal examination by Rankin and Brown (83), 227 were considered to have diverticulitis, from which it would seem that 17 per cent of diverticula produce symptoms. In the autopsy series of 111 cases reported by the same authors, there were 16 cases of diverticulitis (14 per cent).

The symptoms of diverticulitis are apparently due to inflammatory changes occurring in and around a diverticular sac, as a result of inadequate drainage. Abell (2) reminds us that the fecal current in the right half of the colon is largely liquid while that in the left half tends to become more and more solid, with the result that diver-

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ticula in the left colon more frequently show the presence of fecoliths which obstruct drainage and predispose to the development of inflammatory changes.

Brown and Marcley (14) concluded that in one-third of the cases of diverticulitis, symptoms are the result of inflammation, and in two-thirds, the result of obstruction plus inflammation. Provided the disease does not run a fulminating course to perforation of one of the diverticula, the symptoms are more or less classical. With acute inflammation in a single diverticulum the symptoms closely resemble those of appendicitis: pain, nausea and vomiting, localized tenderness and rigidity, and increased leucocyte count. The most typical symptom is pain, usually in the left lower abdominal quadrant. This is frequently associated with constipation. About 60 per cent of patients with diverticulitis give a history of constipation alone or constipation alternating with diarrhea (83). Bleeding is not a very common symptom, being present in from 5 to 17 per cent of cases (Abell, 1, Rankin and Grimes, 84). On rare occasions there is massive hemorrhage (Blackburn, 10, Friedenwald and Feldman, 39), and a purely hemorrhagic form has been reported by Germani, LeGallon, and Morvan (41). Tumefaction associated with diverticulitis is rather common (31 per cent) and is usually the result of inflammatory reaction around the diverticulum, with or without the formation of abscess (Rankin and Brown, 83).

Graham (43) summarizes the symptom complex of diverticulitis as follows: "The patient is over 40 years of age, and has suffered vague, recurring abdominal distress, mostly in the lower abdomen, often radiating into the rectum and relieved by the passage of flatus and stool. Constipation, with rare bleeding and occasional diarrhea is present in a fair proportion of cases. Almost all patients will give a past history of attacks of acute abdominal pain associated with fever."

Roentgenological study constitutes the most important aid in diagnosis, not only in locating the site of the lesion, but in determining as well the extent of the involvement (Abell, 1). There are nevertheless many instances in which roentgen diagnosis has failed. In Graham's series (43), the roentgen-ray diagnosis was correct in only 57 per cent of the cases. Characteristically, there is a serrated or "picket-fence" roentgen appearance of the colon (Stewart and Illick, 101). While the barium enema flows in, there is intermittent obstruction with left lower quadrant pain. Much has been written about the roentgenological differential diagnosis between diverticulitis and carcinoma of the colon (85, 93, 99, 101). The roentgenogram may show diverticulitis, and the lesion causing the symptoms may be carcinoma (T. E. Jones, 56). Yet with all the aids in diagnosis at the command of the diagnostician and roentgenologist, there were 29 per cent of diagnostic errors in Graham's series (43) of which 50 per cent occurred in the differential diagnosis between carcinoma and diverticulitis. The other errors were the diagnoses of acute appendicitis, perforated duodenal ulcer, and acute cholecystitis.

Sigmoidoscopy is of value in the diagnosis of diverticulitis only when diverticula can be seen with direct vision and confirmed with the roentgenogram. Jackman and Pumphrey (52) were able to accomplish this in 66 per cent of cases, but in only 14.5 per cent were sacculations directly visualized. In 22 per cent of cases, suggestive findings were observed proctoscopically; they included immobility, sharp angulation, narrowing of the lumen, mucosal edema, extrarectal mass, and inability to pass the proctoscope the usual distance. The observation of bleeding from above the reach of the instrument is of no conclusive value.

MEDICAL OR CONSERVATIVE TREATMENT

The treatment of the early stages of diverticulitis is not a surgical problem. Even if there is marked deformity of the bowel conservative management frequently causes the process to subside (Dixon, 27).

The medical management of an acute attack consists of complete bed rest and the administration of parenteral fluids in order to rest the inflamed colon and maintain chemical balance. Heat is of great value, and may be administered in various ways. Many authors recommend the application of hot packs or electric pads to the abdomen. Brown and Marcley (14) have used short-wave diathermy with success. Pemberton and Waugh (81) advocate the use of the Elliot treatment, especially in women. Bearse (8) suggests either ice bags or heat placed at the seat of pain in the acute stage. While two-way rectal irrigations with hot physiological saline provide another valuable source of heat, such irrigations may prove irritating and increase the discomfort in some cases (14). Small warm saline (83) or plain water (56) enemas usually suffice to cleanse the bowel. In the acute stages, retention enemas of warm oil (cottonseed oil [110] or olive oil [12]), and glycerin suppositories (56) are often very comforting and help promote bowel movements. Liquid petrolatum (mineral oil), or olive oil by mouth have proved to be of definite value in most

cases. Blackburn (10), however, is convinced that water has more influence upon the consistency of the stool than has oil or fat, and therefore agrees with Jones (54) that when tolerated, plenty of water should be given orally. After subsidence of the acute symptoms, patients should be warned to avoid irritating laxatives and an effort should be made to resume normal bowel movements (6).

As the acute stage subsides, food should be given orally. This should be started gradually and be low-residue or non-residue in nature. As improvement is seen, the diet can gradually be increased to a normal, sensible diet (13). If the bowel habit is on the "loose" side, Willard and Bockus (110) suggest caution in the use of very hot or cold foods or drinks.

Antispasmodics are generally thought to be of value in the treatment of diverticulitis, although some clinicians prescribe the drugs despite doubts as to their efficacy. Belladonna is the most popular of these drugs. Other antispasmodics that have been recommended include stramonium (2), calcium, (110) and hyoscyamus (24), either alone or in conjunction with belladonna. Bismuth subnitrate, barium sulfate, and kaolin are also useful in cases without obstruction (56,110).

Following subsidence of an attack, attention to diet is recommended. However, there is apparently no way by which further attacks may be influenced. Many chronic cases prove self-limiting, while others have repeated recrudescences regardless of treatment.

The results of medical management are difficult to evaluate. In one of the few large series reported recently, Brown and Marcley (14) found medical treatment satisfactory in 63 per cent of the cases and unsatisfactory in 37 per cent. However, in another series, Brown (12) analyzed 92 recent cases of diverticulitis which required surgical treatment, and found that in approximately one sixth of these cases symptoms developed rapidly, and operation had to be performed within a month or less after the first sign of the disease. In fully one-half of his cases operation had to be performed within the first year. In the remaining cases symptoms persisted with increasing severity for from one to ten years before operation was performed. Brown interprets this as an indication of the failure of medical treatment.

In Graham's (43) series of 44 cases coming to surgery, 1 patient had recurrent attacks over a period of fourteen years, 10 had a history of five or six years, and 33 (75 per cent) had symptoms for one year or less. Only 14 of the 44 patients had no remission from the onset until surgical measures became necessary, while 30 gave a history of definite acute attacks. Thus, 66 per cent of the patients coming to surgery in this series had a chronic recurrent abdominal disease.

The age and sex incidence of patients with diverticulitis requiring surgery has a close relationship with the actual age and sex incidence of the disease (Table I).

TABLE I.—AGE AND SEX OF PATIENTS OPERATED ON FOR DIVERTICULITIS OF THE COLON FROM 1919 TO 1938, INCL. (BROWN).

Sex	Age					
	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to 80
Men (122, or 63%)	1	7	34	43	33	4
Women (69, or 37%)	..	2	19	24	22	2
Total (191)	1	9	53	67	55	6

Bearse (8) has calculated that for the entire population the incidence of operation for diverticulitis would be about 186 cases per 100,000, and that for patients under thirty years of age no more than 5.7 cases per 1,000,000 would require surgical intervention. In general, the percentage of patients with diverticulitis who will eventually receive surgical treatment is variously reported, from 15 per cent by Bargen and Coffey (6) to 26 per cent by Brown and Marcley (14).

THE SURGICAL TREATMENT OF DIVERTICULITIS

When a diverticulum and its surrounding structures become inflamed, various complications which require surgical intervention may arise. For the purpose of this review these complications will be classified as follows:

1. Acute perforation of a diverticulum
2. Peridiverticular abscess (chronic perforation)
3. Obstruction
4. Fistula formation
   (a) Colovesical fistula
   (b) Entero-enteric fistula
   (c) Fistula into abdominal viscera other than the bowel
   (d) Abdominal-wall fistula
   (e) Fistula into tissues of the posterior abdominal wall and pelvis
5. Other disease processes

ACUTE PERFORATION

The most dreaded but fortunately the least frequent (83) complication of diverticulitis is the sudden perforation of a diverticulum into the free

peritoneal cavity which causes generalized peritonitis. This complication is rare because peridiverticulitis usually serves to wall off the impending rupture by drawing loops of small bowel to the sigmoid, or fixing the sigmoid to the lateral parietal peritoneum, bladder, or anterior abdominal wall. Consequently, penetration and abscess result more commonly.

In Ochsner and Bargen's series (78), acute perforation occurred in only 2.4 per cent of the total cases of diverticulitis. On the other hand, Graham (43) reported that in 11 of 44 cases (25 per cent) of diverticulitis coming to surgery, acute perforation had occurred and necessitated an emergency operation. Among 127 cases of diverticulitis coming to autopsy, Kocour (62) reported 4 deaths from perforation among 8 fatalities directly attributable to diverticulitis.

Although practically all acute perforations of diverticula occur in or near the sigmoid, they may occur elsewhere in the colon. Abell (1) reported an acute perforation of a diverticulum of the appendix. Erdman (34) recorded 2 cases of multiple perforations. The patients were operated upon for each perforation, and the gangrenous diverticula were found in demonstrably different areas.

In the acute fulminating variety of intraperitoneal perforation of a diverticulum, the symptoms are so alarming that an emergency operation becomes necessary. The resulting diffuse suppurative peritonitis is not distinguishable from that produced by other infectious lesions. The pre-operative diagnosis is generally that of acute appendicitis (Visconti, 106), volvulus, or perforation of a viscus (Jones, 56). Very frequently the sigmoid is in the midline or on the right side.

Graham, Erdman, Jones, and others emphasize that in determining the treatment, the same principles are applicable as in any acute intraperitoneal disease. First, one must correct the biological disturbances which inevitably accompany the disaster by the intravenous administration of fluids and salt, the local application of heat, and the administration of sedatives. A delay of some hours while such therapy is being carried out is perfectly justified by the results.

Because in the vast majority of instances acute perforating diverticulitis presents somewhat atypical symptoms of acute appendicitis, the surgeon unfortunately will usually use a McBurney incision or a right rectus incision. Rankin (84) points out that if this is done, the danger lies in the exploration which is undertaken upon finding a normal appendix. This may spread the infection and, because of the difficulties present, the exploration itself may become a formidable procedure. He therefore suggests that if such an incision has been made, it should be closed immediately and a low midline incision substituted for it.

Once the perforated diverticulum is exposed, there is some difference of opinion as to how to deal with the pathological changes at hand. Abell (1) believes that, if local conditions permit, an attempt should be made to repair the perforation, and adds that a certain percentage of these attempts are successful, while the remainder of the cases, like those treated with drainage alone, develop fistulas. Rankin and Brown (83) remove the offending diverticulum, if possible, close the opening loosely with interrupted sutures, and drain the peritoneal cavity. Erdman (34) concurs in this opinion, adding that in those acute cases in which a mass has not formed, attempts at repair are in order. Cornwall (23) emphasizes this point of view by maintaining that generalized peritonitis due to a ruptured diverticulum should be treated as that arising from a ruptured ulcer or appendix, i.e., by closure of the exit of the septic material from the intestinal lumen, free evacuation, and drainage.

Opposing this form of treatment are a number of surgeons who do not believe any attempt at repair should be made. Jones (56) believes that the immediate responsibility is to save the patient's life, and therefore advises the procedure which most simply accomplishes this purpose: incision and drainage. No attempt is made to close over the perforated area, because the sutures will not hold in the edematous, infected bowel wall. Furthermore, it is traumatizing and time-consuming and may conceivably break down protective barriers. Graham (43) also follows these principles by performing simple drainage, using a rubber tube surrounded by gauze soaked in liquid paraffin and "bipp."

Some surgeons prefer a more formidable procedure, namely, exteriorization of the loop bearing the ruptured diverticulum. Marshall (72), Black (9), and others consider this the best form of treatment, but Marshall adds that when the bowel cannot be exteriorized, simple anchorage of the affected segment under the incision and rubber-dam drainage down to the bowel is comparatively safe.

Since a fistula frequently follows closure and drainage, Rankin (84) supplements this with a colostomy which shunts the fecal current and allows inflammatory changes to regress. He claims the procedure takes but a few minutes and is not traumatizing. However, Graham and Jones point out that one of the contributing factors to

the high mortality in this condition is an unduly extensive procedure. A coincident colostomy is often unnecessary and in addition may be difficult to close. If the obstruction is severe enough to require decompression of the proximal colon, it is considered better by some to do a cecostomy.

Slesinger (94) has shown that the prognosis depends on the interval that has elapsed between the time of the perforation and operation. Jones believes that if the surgeon does not see the patient until after twelve or twenty-four hours, the question of expectant, symptomatic treatment must be carefully considered, and suggests the judicious use of sulfanilimide.

PERIDIVERTICULAR ABSCESS (CHRONIC PERFORATION)

Abscess formation with localized peritonitis is the most common complication of diverticulitis (83). It is universally agreed that this condition demands surgical intervention, although there is still some difference in opinion as to which surgical procedure to follow.

The chronic (gradual, progressive) type of perforation with formation of peridiverticular abscess must be differentiated from carcinoma of the colon. In favor of abscess is a history of several previous attacks with pain and elevation of the temperature. Constipation is the rule, and blood is found in the stools only occasionally. Rectal examination will reveal a tender mass in the pelvis. In the female such cases are frequently called tubo-ovarian abscess (Wetherell, 109). In men, early symptoms may point to the genito-urinary tract, with frequency and pain in the lower part of the abdomen which is referred to the kidney. This is due to the proximity of the inflammatory process to either the bladder or ureter. Jones (55), Stenstrom (99), and Renander (85), warn against the injudicious use of roentgenography when an abscess is suspected.

In 1929, W. J. Mayo (73) advised that an abscess resulting from diverticulitis should be evacuated immediately, and some surgeons rigidly adhere to this principle. The trend in the past few years, however, has definitely been toward conservative management when possible, before resort is made to surgical intervention.

Wetherell (109) is convinced that proper conservative treatment will often allow the complete subsidence of an abscess and of marked inflammation of the colonic wall. Slesinger (94) believes medical treatment offers a good prognosis, but must be persisted in until all tenderness and pyrexia have disappeared, and must be followed by careful prophylactic measures. These views are shared by many present-day surgeons (Abell, 1, Smeaton, 95).

If the abscess does not subside, surgical intervention must be considered. The usual procedure is simple drainage. Bailey (4) emphasizes utmost care in technique, with sharp dissection, careful walling off, and bringing the drain tubes out through a separate left gridiron incision after approximating the omentum to the left iliac fossa and folding the apron around the drains. Drainage may be done abdominally, retroperitoneally, or rectally (Weible, 108), and depends upon the location of the mass and the experience of the surgeon. Vaginal drainage is contraindicated because of the possibility that a persistent fecal fistula may follow such drainage.

On rare occasions the surgeon may be confronted with a problem which will compel him to do a radical operation in the presence of infection. After the foul pus of the abscess is removed by suction, a large, necrotic defect may be revealed in the sigmoid. In such cases, closure of the defect is impossible, and transperitoneal drainage may lead to fatal peritonitis. This leaves resection of the Mikulicz type the only reasonable alternative (18), provided liberal drainage is allowed.

If the abscess is associated with obstruction, diversion of the fecal current is indicated. Although some surgeons still prefer to do a colostomy in the descending colon, most writers recommend making the stoma in the transverse colon. Others prefer cecostomy, Wetherell (109) stating that a colostomy adds from 50 to 75 per cent to the mortality. Shipley and Gerwig (92), however, do not believe cecostomy adequately diverts the fecal current.

After drainage with or without colostomy, adequate time should be allowed for healing. This period may be from two to four months or several years. After this period, resection may prove necessary if the disease does not subside entirely.

The important point repeatedly found in the literature regarding the treatment of peridiverticular abscess is that radical surgery should not be attempted in the presence of acute inflammation, unless absolutely indicated. When adequate time has elapsed after drainage, the surgeon is in a better position to determine whether the affected segment should be removed, or whether the resulting fistula should be allowed to heal or be closed surgically.

OBSTRUCTION

Although much has been written about the management of this complication of diverticu-

litis, there is by now almost universal agreement, at least in principle, as to the therapeutic course to follow.

Obstruction in acute diverticulitis occurs as a result of infection and edematous thickening of the gut wall and of the mesocolic and surrounding fat. Acute obstruction is usually associated with acute diverticulitis, although it may also occur in chronic diverticulitis. In other words, a sudden, acute obstruction may arise even though the infectious process has been present in varying degrees for some time. Obstruction may develop while waiting for an abscess to point (56).

W. J. Mayo (73) believed that for acute obstruction due to diverticulitis, a colostomy should be performed immediately, and as close to the obstructed point as convenient, so that at a later operation the stenosed portion of the sigmoid and the colostomy opening may be excised together.

The trend in the past few years, however, has been toward postponing operation as long as possible.

Obstruction of the terminal colon is not of the same serious import as obstruction of the small intestine. As a rule this obstruction is preceded for several days by a gradually increasing partial obstruction, with cramps, followed by the expulsion of gas and either solid or liquid feces, with temporary relief. During this stage Wetherell (109) urges complete rest in bed, liquid diet, or even entirely parenteral fluids. This regime for one or two weeks will, in the majority of cases, in a first or second attack, result in recession of the inflammatory condition and re-establishment of a lumen sufficient to permit passage of fecal material. Complete low obstruction may be tolerated for from ten days to two weeks, and these patients, too, will usually respond to non-operative measures. Abell (2) agrees with this principle, but when the obstruction is complete, prefers to do a colostomy rather than wait.

When operation is done, the site of the colostomy depends upon the site of the obstruction and the procedure the surgeon proposes to follow after the inflammation has subsided. Jones (56) does a left inguinal colostomy if the process is low in the sigmoid. If the mass is definitely palpable in the left lower quadrant, he advises a transverse colostomy. Edwards (32) has very little faith in the value of colostomy in the treatment of obstructive diverticulitis, but when it is inevitable, prefers to do it as close to the inflammatory site as possible.

Some surgeons elect to do a cecostomy or ileostomy in order to stay as far away as possible from the inflammatory site. Another advantage of this form of treatment is that it prevents other diverticula above the offending lesion from becoming inflamed.

If while waiting for an abscess to point, obstruction develops, and if the process seems to be localizing otherwise, a cecostomy or transverse colostomy should be done (56), and at the appropriate time, a left McBurney incision made and the abscess drained.

Chronic obstruction is due to hyperplasia, adhesions, and angulation. This obstructive type of diverticulitis is most frequently mistaken for carcinoma of the colon (Slesinger, 94). It is characterized by gradually increasing constipation progressing to obstruction, associated with pain and tenderness in the left iliac fossa, pyrexia, and sometimes the presence of a tumor.

In such a case, clinical judgment alone decides the optimum time for surgical intervention. The duration of the ailment, the general condition of the patient, the degree of distention, and the presence of vomiting, all must be considered in the decision. If conservative management has been given a fair trial and has failed, the operation of choice is a colostomy some distance above the mass.

The usual interval treatment should be carried out, and, after convalescence, progress studies by means of the roentgenogram and the sigmoidoscope will determine the future course to be taken. Many authorities believe that the stoma should not be closed before a year has elapsed. Obviously, one must be sure before closing the colostomy opening, that there is no remaining obstruction. If the colostomy is closed, the patient must be put on rigid bowel management in an effort to avert further trouble.

If complete healing does not take place, resection must be considered. The choice of procedure depends upon the condition of the patient and the extent of colon involvement. Jones (56) has suggested that if the process is limited to 4 or 6 in., resection of this segment should be considered; but if the roentgenogram shows the process to be more extensive, resection may not be advisable. In such cases, permanent colostomy is recommended. If the patient insists that the colostomy be closed, he should be warned of the possibility of recurrence.

For the excision, an operation of the Paul-Mikulicz type is apparently the safest (Slesinger, 94). However, Rankin and Brown (83) have found that the most frequently performed operation has been removal of the affected sigmoid with end-to-end anastomosis. In a few cases Jones (56) has found it possible to do a primary Mikulicz

operation, but hastens to warn that the mobilization may not be wise in most cases.

FISTULA

A peridiverticular abscess may perforate (a) into the urinary bladder, (b) into the adjacent bowel, (c) into abdominal viscera other than the bowel, (d) through the anterior abdominal wall, and (e) into tissues of the posterior abdominal wall and pelvis. The perforations result in fistulas between the bowel and these organs or tissues. Fistulas to the anterior abdominal wall are frequently the sequel to surgical drainage of a peridiverticular abscess.

Colovesical fistula (so-called vesicocolic fistula). According to Doherty (29), there are two types of colovesical fistulas resulting from diverticulitis: (1) those due to abscess formation with a long track to the bladder; and (2) those which result from the obstructive type of diverticulitis, in which there is a short track through which a great part of the fecal stream passes into the urinary bladder.

Edwards (32) observed that colovesical fistula was five times more common in men than in women (in women the bladder is largely protected by the uterus and the fallopian tubes) and that the ages ranged from forty-four to sixty-nine years. In Rankin and Brown's series (83) of 48 surgical cases of diverticulitis, 7 or 14.5 per cent of the patients had fistulas into the bladder, although 13 or 26 per cent had urinary symptoms. This coincides with Brown's series (12), in which 30 or 15 per cent of 191 patients on whom surgical treatment was employed developed colovesical fistulas. Gouvernour, Soupalt, and Latifi (42) found such fistulas in 38 or 11 per cent of 324 cases of diverticulitis of the sigmoid, and Lockhart-Mummery (67) encountered this condition in 12 of 91 cases of diverticulitis upon which he operated. Higgins (48) reviewed 328 cases of colovesical fistula in 1936, of which 160 were inflammatory in origin. Of these 57.5 per cent had diverticulitis of the sigmoid and rectum as their initiating cause.

Abdominal symptoms usually precede the urinary symptoms by a considerable length of time. Edwards (32) found the appearance of a colovesical fistula was preceded by abdominal symptoms by three years and nine months on the average.

The treatment depends upon several factors, although, again, the trend is for the most part toward conservatism, and there is general agreement as to the procedures advocated.

The first essential in the treatment of colovesical fistula is to prevent fecal material from reaching the fistulous tract. Colostomy is therefore usually advised, either high in the sigmoid, in the transverse colon, or cecum. If an abscess is present, it should be evacuated, and complete subsidence of the disease should be awaited before attempts at repair are instituted. Slesinger (94) warns that unless the cystitis is speedily relieved, renal infection and death frequently follow. After the preliminary colostomy, the usual period of interval treatment is undertaken; this treatment includes heat, irrigations, and dietary measures, in order to allow complete quiescence of the inflammation.

While the operative correction of colovesical fistula may in some instances prove relatively easy, in others it entails difficult and hazardous procedures. Dixon (27) believes that a colon resection with closure of the bladder opening is almost invariably necessary. If the opening is located low down in both organs, the difficulty of access combined with the inflammatory infiltration makes its correction very hazardous. In such cases Abell (1) elects to do a permanent colostomy and claims satisfactory results.

Jones (56) depends largely upon the barium enema, and cystoscopic and cystographic findings to decide upon which course to follow. From roentgen findings one can decide whether to close the colostomy if the bladder fistula is closed, or resect the process before the colostomy is closed. The choice of procedure depends upon the amount of bowel involved. If the segment is short, resection is the treatment of choice. If it is long, it is advisable to keep the colostomy for a long time even if the fistula has closed spontaneously.

Rankin and Brown (83) are inclined to perform the surgical procedure in one stage by closing the two openings and hoping for primary union, but they add that a graded operation, namely, colostomy first and subsequent attention to the fistula may be done with lower mortality and more satisfactory end-results. C. J. Mayo (73) recommended interposing omentum between the bladder and bowel, and around the latter, which is finally sutured to the abdominal wall. Dixon (27) often supplements resection with a suprapubic cystotomy which is allowed to function for from three to five weeks.

Entero-enteric fistula. Perforation of a peridiverticular abscess into the rectum is a fortunate occurrence (36,54), and brings about sudden relief from pain. A fistula may persist for a short while after rectal evacuation of the abscess, but will soon heal under conservative treatment.

No reports are available regarding fistulas to the small intestine due to diverticulitis of the

colon, but in Rankin and Brown's series (83) 1 such case was successfully operated upon by simply breaking down the adhesions and closing the fistulas in the intestine.

Fistula between colon and adjacent viscera other than the bowel. Harries (47) reported the perforation of a peridiverticular abscess into an ovarian cyst, with recovery after drainage. Kocour (62) described a perforation into the cervical canal of the uterus in a patient who died after the abscess ruptured into the free peritoneal cavity. Weible (107) warns against draining an abscess due to diverticulitis through the vagina because of the danger of a colovaginal fistula, but reports no such cases.

Anterior abdominal-wall fistula. Whether a peridiverticular abscess ruptures spontaneously or is opened surgically, a fistula generally results. Some fistulas which are the result of surgical drainage of an abscess are of small caliber and frequently heal spontaneously (2). However, Bargen and Coffey (6) point out that it may not always be wise to allow this to happen. The infectious process in the bowel must be completely healed before spontaneous closure of the fistula should be permitted.

In persistent fistulas, surgical closure usually fails unless a colostomy is done proximally before closure of the fistula is attempted. Many persistent fistulas will heal spontaneously after the fecal stream has been diverted by this procedure. Dixon (27) advises waiting from four to six months after abscess drainage for the resulting fistula to heal. If healing does not occur within this period, he recommends that colostomy be done. Jones (56) observed that nothing should be done about fistulas in patients who did not require a colostomy, because they usually close spontaneously even after as long as fifteen months. The fistula is very little nuisance, generally discharging pus, but rarely any fecal material.

If after colostomy, the fistula does not heal spontaneously, and the question of surgical closure arises, Jones (56) recommends injecting the sinus with bismuth and by means of a barium enema determining the extent of the process in the colon. If a small segment is involved, resection of that segment including the fistula may be undertaken before the colostomy is closed. He believes it is not good surgery to dissect out the fistula down to and including the diverticulum and to try to close the bowel over, because it will fail in most cases, and the fistula will reform. If the entire sigmoid is involved, the patient should be encouraged to keep the colostomy, but refusing this, he must realize that the abdominal sinus will probably be permanent. This causes little inconvenience provided it is kept open and allowed to drain. Bargen and Coffey (6) advise saline irrigations of the idle lower loop for three months or more in an attempt to further heal the process in the colon. Dixon (27) believes in surgically closing the fistula after colostomy has been done, provided the extent of the diverticulitis does not demand a segmental resection.

Fistula from colon to tissues of the posterior abdominal wall and pelvis. A diverticulum of the upper rectum may perforate into the surrounding tissues, resulting in a sinus to the ischiorectal space which simulates an ischiorectal abscess (34). Jones (56) warns that it is well to bear in mind that a chronic fistula in and around the rectum which has been attributed to a fistula-in-ano or to a pilonidal sinus may have its origin in diverticulitis of the lower sigmoid. He therefore recommends injection of every chronic, recurring, complicated fistula-in-ano before operation.

Lyall (71) reported a psoas abscess resulting from a ruptured diverticulum of the sigmoid, which extended down the inguinal ligament into the thigh to a point just above the knee.

OTHER DISEASE PROCESSES

Pylephlebitis. Often unrecognized is the pylephlebitis around an area of diverticulitis. David and Gilchrist (26) report 2 such cases. Cooke (22) reported a case diagnosed ante mortem as Weil's disease, which proved at autopsy to be one of diverticulitis terminating in pylephlebitis of the inferior mesenteric and splenic veins, with multiple abscesses in the liver.

Chronic septic foci. Spriggs (97) found chronic septic foci elsewhere in the body in 44 of 152 cases, which he attributed to diverticulitis as the source of infection. Lockhart-Mummery (67) found similar complications in 14 of 136 cases, and was convinced that the original diverticulitis was responsible, especially as none of 13 patients successfully treated by resection developed such foci. These included arthritis, endocarditis, septic iritis, and brain abscess. Coleman and Capps (20) attempted to trace the source of such infections, by roentgenographic studies of the bowel and stool cultures. In only 2 of 11 cases of diverticulitis were they unable to isolate streptococcus hemolyticus from the stools.

Carcinoma. Since Moynihan in 1907 first called attention to the mimicry of carcinoma by diverticulitis, much has been written about a possible relationship between these diseases. It has been shown beyond question, however, that there is no causal relationship between diverticulitis and car-

cinoma. Reports have shown a concomitant incidence of these two conditions varying from 1.5 to 8 per cent (Abell, 1). This is generally interpreted as a coincidence rather than assuming that diverticulitis is a precursor to carcinoma.

However, the differentiation between carcinoma and diverticulitis is often extremely difficult, not only clinically (Schwarz, 90), but often at the operating table. Because of adhesions to the urinary bladder, it is sometimes difficult to decide whether carcinoma is invading the bladder, or whether the mass is purely inflammatory, or whether it is carcinoma plus diverticulitis (42). The error of undertaking a radical procedure in one stage for diverticulitis is sometimes due to the impression that the pathological changes present are due only to carcinoma. On the other hand, there are probably many cases of supposed long-term cures of carcinoma of the lower colon after simple colostomy, which were in reality cases of diverticulitis (W. R. Jones, 57). Rankin and Brown (83) are of the opinion that when carcinoma is believed to be present, even though one may not be absolutely sure of it, resection is indicated.

Other diseases. In Kocour's autopsy series (62) he found that the incidence of lesions of the gall bladder in patients over forty years of age was doubled in those with diverticula. However, the incidence of peptic ulcer or of carcinoma was not altered by the presence of diverticula.

Abdominal surgery in the presence of diverticulitis. David and Gilchrist (26) have pointed out some of the hazards of surgery on the left half of the colon in the presence of diverticulitis. In the one-stage abdominoperineal resection for carcinoma, one may be considerably hindered by firm adhesions of the sigmoid loop to the peritoneum of the small pelvis and bladder caused by peridiverticulitis. Thus when the sigmoid is finally freed, there is little peritoneum of suitable quality left for peritonization.

Diverticula may be inadvertently opened when mobilizing the sigmoid in a Miles resection, when ligating appendices epiploicæ (26), or when severing the meso-appendix in the performance of an appendectomy (1). Such occurrences may result in fecal fistula, localized peritonitis, or fatal peritonitis.

The increased intra-abdominal pressure produced by leaving the ligature or clamps on an end-colostomy for from one to three days, may result in perforation of a diverticulum. Deep abdominal-wall infections with reflex ileus following surgery on the colon, are often the result of contamination from an opened or traumatized diverticulum.

MORBIDITY AND MORTALITY

Statistical material on the mortality and end-results of the surgical management of diverticulitis is somewhat meager, since there are very few large series of surgically treated cases of diverticulitis. Furthermore, various authors analyze their mortality statistics from different approaches, so that an average cannot be drawn from these series. Also, there are very few follow-up studies from which the end-results after the various operative procedures can be estimated.

However, several of the largest series published in recent years do lend themselves for comparison if the procedures are divided into conservative and radical operations. Conservative operations include colostomy alone, colostomy and subsequent closure of the colostomy, cecostomy, drainage of abscess, exploratory laparotomy, separation of adhesions, excision of inflamed diverticula,

TABLE II.—MORTALITY RESULTS FOR OPERATIONS PERFORMED FOR DIVERTICULITIS OF THE COLON AND ITS COMPLICATIONS

Author	Number of cases operated	Conservative operations*				Radical operations†				Total surgical mortality	
		No.	Per cent	Mortality		No.	Per cent	Mortality			
				No.	Per cent			No.	Per cent	No.	Per cent
Rankin & Brown	48	15	31.2			33	68.8	6	18.2	6	12.5
Brown & Marcley	88	40	45.4	3	7.5	48	54.6	9	18.8	13	14.7
Lockhart-Mummery	91	74	81.3	9	12.2	17	18.7	4	23.5	13	14.0
Brown	191	105	55.0	15	14.3	86	45.0	20	23.3	35	18.3
T. E. Jones	16									2	10.0
Totals	434			27	*11.8*			39	*21*	69	*15.9*

*Conservative operations include: colostomy alone, colostomy and subsequent closure of the colostomy, cecostomy, drainage of abscess, exploratory laparotomy, separation of adhesions, excision of inflamed diverticula, and repair of colovesical fistula not involving resection.

†Radical operations include: resection after preliminary colostomy, Mikulicz type resections, resection and anastomosis after previous colostomy, obstructive resection with subsequent closure of the colostomy, and one-stage resections.

and repair of colovesical fistula not involving resection. Radical operations include the various procedures involving resection of the diseased portion of colon, such as resection after preliminary colostomy, Mikulicz type resections, resection and anastomosis, obstructive resection with subsequent closure of the colostomy, and one-stage resections. (See Table II.)

Obviously, this method of tabulation is open to criticism, but, nevertheless, it reveals several interesting features. The average mortality for conservative operations was 11.8 per cent, ranging from 7.5 to 14.3 per cent. Radical operations performed for diverticulitis carry an average mortality of 21 per cent, ranging from 18.2 to 23.3 per cent, when both one-stage and two-stage procedures are grouped together. Upon analysis of individual reports it was found that the Mikulicz type resection apparently carried the lowest mortality of the radical procedures. Resection and anastomosis, and obstructive resections with subsequent closure of the colostomy were found to have a combined mortality of about 25 per cent.

Unfortunately, as stated, there are few statistical reports regarding morbidity (failures, fecal fistulas, reports of "not well") following operations for diverticulitis of the colon. The only comprehensive report of such statistics is that of Brown (12), which is of considerable value in determining the fate of these patients, especially when combined with a few isolated reports of smaller series. Total failures after conservative operations were found to average 32 per cent, while those following radical operations averaged 9 per cent.

It might, therefore, be assumed that although radical operations have twice the mortality of conservative operations (21 and 11.8 per cent, respectively) in the treatment of complicated diverticulitis, the percentage of failures following radical operation is about one-third that following conservative procedures.

This must not be construed to mean that radical operation is necessarily the procedure of choice, despite its higher mortality, because it effects a greater number of cures. It might rather be interpreted to mean that if further radical therapy becomes necessary because of failure of more conservative measures, an additional mortality of 20 per cent must be anticipated, as must, also, a number of cases (9 per cent) which will fail to be cured. However, if a radical procedure is attempted without a preliminary conservative operation, a still higher mortality must be expected. For all operations done for diverticulitis, Brown found an average mortality of 18.3 per cent, and total failures amounting to 17.8 per cent.

That the mortality rate has diminished sharply in the past two decades is evidenced by comparing Lockhart-Mummery's recent series (67) which had a 14 per cent mortality, with his report of 1910 (66), in which there was a 46 per cent mortality.

TABLE III.—RESULTS OF SURGICAL TREATMENT IN 191 CASES OF DIVERTICULITIS (BROWN).

Results	Years since operation				Total
	0 to 5	5 to 10	10 to 15	15 to 20	
Patients cured	34	25	21	4	84
Symptoms persist	21	6	6	1	34
Related deaths	33	2			35
Deaths from unrelated or unknown causes	16	7	4		27
No data					11

The late results are governed by many factors, the chief one being the fact that many patients are in the sixth or seventh decades of life. Brown, in analyzing his data (Table III), found that 56 per cent of the 180 cases in which follow-up data were obtained, were benefited by operation. Even in many of the cases in which symptoms persisted, the patients were not invalids, and many would have died had they not been treated surgically. Sixty-one of Brown's patients lived at least five years or more. Even though a patient has a persistent fecal fistula or colonic stoma he is fortunate in being free from pain and able to carry on usual duties.

From the available data it may be assumed that of 200 patients with complicated diverticulitis, two-thirds or 134 will be benefited by medical treatment. Of the remaining 66 patients, about 33 (17 per cent of the total) will undergo surgery. After a primary (conservative) operation, 4 (12 per cent) will die and 12 (32 per cent) will not be cured, while the remaining 17 patients will be benefited. If 15 patients (10 uncured and 5 benefited by conservative operation) are then subjected to a radical (resection) operation, 3 (21 per cent) will die and 1 or 2 (9 per cent) will go on having symptoms despite all their treatment. Add to these the failures after conservative operation not followed by radical operation, and one is confronted with a total of about 18 per cent of failures following surgery for diverticulitis of the colon, and a total operative mortality of about 16 per cent.

SUMMARY

It is generally accepted that diverticulosis *per se* produces no symptoms and warrants no treatment. In the early stages of diverticulitis surgical intervention is not usually indicated. With the supervention of such complications as acute perforation, abscess, obstruction, or fistula, the treatment may become surgical. The trend in the past five years has been toward conservative management and the prevention of operation whenever possible.

Complications may develop in spite of competent medical treatment, but because of the high mortality attending the surgical approach and the incidence of failure after operation, surgery should be avoided whenever possible. It must be recognized that frequently prolonged hospitalization and graded operations may become necessary. This introduces an economic factor which should be considered before surgical treatment is resorted to in chronic cases of diverticulitis.

Emergency surgical interference may become necessary when acute perforation of a diverticulum occurs. In chronic, complicated cases, surgery may have to be resorted to if medical measures fail. In either case it is agreed that the surgical procedure undertaken should be of the most conservative type which will adequately deal with the disease. This usually consists of drainage or colostomy or both. If there is not complete subsidence of the disease process after months of interval treatment, the involved segment of bowel may have to be resected. It is emphasized that care must be taken in selecting cases suitable for resection.

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SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Junghanns, H., and Juzbašić, D. M.: Closure of Large Hernial Apertures by a Skin-Flap Plastic Operation (Verschluss grosser Bruchpforten durch Cutislappenplastik). *Chirurg*, 1940, 12: 742.

The skin-flap plastic first improved by Loewe and later by Rehn has again been taken up with satisfactory results and carried out in more than 30 cases. Its field of application includes the large abdominal cicatricial hernias and recurrent hernias, the umbilical hernias, and large hernias of the lower white line, and occasionally the recurrent inguinal hernias. The special advantage of the skin flap lies in the fact that it is firmer than every fascial flap, that it is always available in the human body in sufficient amount, and that it can be taken from the operative site itself.

The skin site intended for the removal of the skin flap requires an eight-to-ten days' preliminary treatment with soap and brush, a twice daily rubbing with a 5-to-10 per cent alcoholic tannin solution, and the application each time of a renewed sterile dressing. No signs of irritation were observed from this treatment. The corresponding large skin flap is freed of epidermis by repeated scraping and separated from the fatty tissue.

In the exposure and preparation of the actual hernia, attention must be paid to the most extensive restoration possible of the abdominal wall. The suturing of the flap is done under rigid tension, with overlapping of the spaces toward both sides and with the scraped epidermal layer upward, in order to lead rising infections outward. The great danger with submerged skin flaps is the infection, which is best combated by the preliminary treatment mentioned.

Bacteriological tests in 12 examinations revealed sterility of the skin flaps only 3 times, and white hemolytic streptococci were strikingly common. The permanent results were satisfactory. Two illustrations elucidating the text, and 4 pictures of an abdominal cicatricial hernia cured by a skin plastic are shown in the original article.

(Makowsky). Louis Neuwelt, M.D.

Moore, T.: Mesenteric Vascular Occlusion. *Brit. J. Surg.*, 1941, 28: 347.

Occlusion of the mesenteric vessels is by no means a rare occurrence. The mortality resulting from the disease is still very high and can be reduced only by earlier diagnosis and treatment.

Although anemic infarction may occur, hemorrhagic infarction occurs more commonly. In this condition the bowel is swollen, rigid, and usually of a dark venous-red color. The mesentery shows similar changes. Microscopic examination shows that the bowel wall is completely infiltrated with blood.

Venous obstruction occurs in 75 per cent of the cases of circulatory obstruction. When arterial obstruction occurs, it is due either to embolism or to thrombosis. Thrombosis is always the cause of the venous obstruction. The two main factors responsible are portal obstruction and peripheral sepsis.

The disease is characterized by the sudden onset of central abdominal pain, shock, severe colic, nausea, vomiting, and either complete intestinal obstruction or the repeated passage of bloody feces. As the condition progresses, distention, fecal vomiting, dehydration, low blood pressure, a rapid feeble pulse, and abdominal tenderness with rigidity are observed. It is uncommon for the disease to be correctly diagnosed before operation.

Moore urges immediate abdominal exploration as soon as the patient can be made as safe for surgery as possible. He believes that excision of the affected bowel and mesentery should be done even in desperate cases. "If the patient dies on the table, it is certain that no good would have followed exteriorization."

In the author's experience 8 cases have been observed. In 7 operation was done with a resulting mortality of 60 per cent. Earl Garside, M.D.

GASTRO-INTESTINAL TRACT

Reich, N. E.: Gastric Diverticula. *Am. J. Digest. Dis.*, 1941, 8: 70.

In a series of 19,022 gastric examinations, 6 cases (0.03 per cent) of gastric diverticula were found. These cases are reported, with 2 additional cases from private practice. These diverticula were all located near the posterior wall of the cardia on the lesser curvature, which is the most common location of this lesion. The patients' ages ranged from thirty-six to seventy-one years. The fact that gastric diverticula appear in the human embryo suggests that their presence in the adult may frequently be due to a persistence of the fetal diverticulum. There is apparently a local predisposition, since in the cardiac end they commonly occur when the layer of longitudinal muscle fibers divides into two fasciculi. Here the mucosa is covered only by circular fibers.

The author classifies gastric diverticula into congenital, acquired, and false types. He does not believe a pulsion type exists. The false type is represented by the absence of at least one layer, usually that of the mucosa, with a defective muscular coat, due to ulcer or cancer. Associated gastric disease is found in about one-third of all cases of gastric diverticulum. The numerous complications associated with diverticulum of the colon do not affect the stomach, probably because of the good blood supply to the cardia, and also because of the mobility and activity of the stomach and its relative freedom from bacteria.

The majority of diverticula either fail to produce symptoms or cause only vague abdominal discomfort. Most cases are discovered accidentally during gastric examinations for other causes, during operation, or on post-mortem examination. When symptoms occur they begin in the fourth and fifth decades and are in order of frequency: epigastric pain, which may be aggravated or relieved by food; vomiting; belching; epigastric tenderness; dysphagia; abdominal distention; and bleeding. When the more common lesions, especially ulcer and carcinoma, have been ruled out, gastric diverticula should be considered as a cause for these symptoms.

Roentgenological criteria for the diagnosis of gastric diverticula are outlined. Skilled gastroscopic examination helps in establishing the diagnosis. The conditions most easily confused with gastric diverticulum are penetrating ulcer and diaphragmatic hernia. Medical treatment of symptoms due to gastric diverticulum is unsatisfactory. If it is concluded that the symptoms are due to a diverticulum, surgical removal should be performed.

JOHN L. LINDQUIST, M.D.

La Cava, G.: Bilirubinemia and Its Significance in Gastro-Intestinal Ulcer and in Colitis (La bilirubinemia e il suo significato negli ulcerosi gastroduodenali e nei colitici). *Policlin.*, Rome, 1940, 47: sez. prat. 2193.

La Cava discusses the data acquired on bilirubin: its origination, the enterohepatic circulation of the biliary pigments, the condition of bilirubin in the blood as revealed by the Van den Bergh test, and the normal values of bilirubinemia and its clinical value. He recalls the results obtained by other authors in their study of bilirubinemia in cases of gastroduodenal ulcer, appendicitis, and colitis; all showed that in most patients having these disorders there is an increase in the bilirubinemia, which reveals some degree of alteration of the biliary function; but the exact mechanism of the production of this alteration is still unknown. As a contribution to the study of the relationship between lesions of the gastrointestinal tract and changes in hepatic function, the author has investigated the bilirubinemia of the patients admitted with gastroduodenal ulcer or colitis to the surgical clinic of the University of Pisa before they were subjected to intervention. He used the following technique: blood was taken from the fasting patient and 0.5 c. cm. of serum was mixed with 1 c. cm. of 96 degree alcohol; after centrifugation for ten minutes, 1 c. cm. of the supernatant fluid was collected and put in the cell of a colorimeter; 0.25 c. cm. of the diazo reagent and 0.5 c. cm. of alcohol were added and the mixture was compared with the standard solution, the color of which corresponds to a 1/200,000 solution of azobilirubin. Considering this solution as the bilirubinemic unit, Van den Bergh accepts from 0.20 to 0.60 B.U. as the normal values for human serum.

The material of the author included 24 patients who did not show any clinically demonstrable changes in the liver. All the values found were higher than those considered as normal by Van den Bergh, and those of the patients with ulcer were generally the highest; the average for the colitis patients was 0.86 B.U., and for the ulcer patients 0.96 B.U. This raises the question of the significance of these findings.

Physiology teaches that an increase in the bilirubin of the blood serum may be due to an increase in the hemolysis, an alteration of the function of the polygonal cells, or an impediment to the outflow of the bile. The first possibility can be excluded as no increase in the hemolysis was observed in these patients, who, in addition, did not present organic conditions favoring hemolysis.

The second possibility may find some justification in the intimate physiopathological relations existing between hepatic and gastro-intestinal functions. A series of gastro-intestinal disturbances have been attributed to hepatic insufficiency. However, careful study of the histories of the patients with associated gastro-intestinal and hepatic disorders showed that in at least the majority of the cases the hepatic disturbances appeared later and were probably secondary; the increase in bilirubinemia would seem to be the first sign of involvement of the liver. The production mechanism of this hepatic alteration is still obscure, but it is plausible to attribute it to the passage through, or the accumulation in, the liver of toxic or, rather, abnormal substances originating in the gastro-intestinal tract. The increased bilirubinemias of patients with ulcer and colitis would thus be included, at least through some of their aspects, in the group of those of toxic origin.

The third possibility has given rise to various explanatory hypotheses, such as biliary stasis due to angulation of the hepatic duct or of the choledochus from adhesions, reflex spasm of the extrahepatic biliary ducts, peripapillary edema of the ampulla of Vater, or partial obstruction of the intrahepatic biliary canaliculi caused by inflammatory proliferation of the connective tissue of the portal spaces with their subsequent cicatricial retraction. The first and last hypotheses may apply in some cases, but cannot be generalized. However, the hypothesis of a functional obstruction of spastic or atonic type is more acceptable and is applicable to all cases; besides, a dystonic condition of the biliary tract has been demonstrated by Becchini in most ulcer patients. The primary cause of the functional change in the biliary tract is not easy to discover and the problem must be approached from the strictly etiological point of view, which offers two basic possibilities. The biliary dyscinesia may be primary and depend on neurovegetative factors: increased bilirubinemia and dyspeptic symptoms would result from the originally altered outflow of bile into the duodenum. The biliary dyscinesia may also be secondary to toxic or irritative factors originating in the gastrointestinal tract as a result of either an anatomical or functional change in the latter.

RICHARD KEMEL, M.D.

Schattenkerk, J. C. P. Eeftinck: Fatal Bleeding from Gastric Duodenal Ulcers (Drohende toedliche Blutung ans Ulcus ventriculi bzw. duodeni). *Nederl. Tijdschr. s. Geneesk.*, 1940, p. 3477.

Perforation of gastric or duodenal ulcer into the free peritoneal cavity is universally accepted as an emergency to be treated by immediate surgery. Acute massive hemorrhage is now also considered by the author as an indication for prompt surgical intervention. Conservative management for hemorrhage has been based on the faulty conclusions drawn from statistics in which all types of hemorrhage were included. These statistics showed that conservative management had a mortality of from 1.2 and 2.5 up to 4.5 per cent, but when the cases of massive hemorrhage were considered alone, the results of conservative therapy varied from 17.8 to 74 per cent. This mortality led Finsterer in 1920 to advocate early gastric resection for these patients. But, as late as 1936 von Bergmann opposed emergency surgery for acute massive hemorrhage because he had a 100 per cent mortality in his last 5 consecutive cases.

Schattenkerk reviewed the autopsy material in a large hospital and found that in 980 cases in which the patients were more than twenty years of age 12.4 per cent of the mortality was secondary to hemorrhage from gastric or duodenal ulcers. In 22 of 417 patients having a history of acute massive hemorrhage, surgical therapy consisting of 4 resections, 15 jejunostomies, and 3 gastro-enterostomies gave a mortality of 36 per cent. However, surgical intervention in all of these cases was done only as a final life-saving procedure in exsanguinated individuals. On the basis of these observations and his own experiences, the author concludes that every patient with massive hemorrhage may bleed to death. When the patients on conservative management do not respond favorably within a few hours, and there is a recurrence of bloody emesis, tarry stools, progressive increase in pulse rate, and anemia, surgical intervention should be instituted under a local anesthetic following blood transfusion and intravenous infusion. With this routine, provided the anemia is not too great, there is less danger than in waiting. Resection of the stomach in large indurated ulcers gave the best results. In those cases in which the general condition does not permit resection, or when a definite ulcer is not demonstrable a life-saving jejunostomy should be done.

No fixed routine can be established, but the author is not of the opinion that primary operation should never be done for massive hemorrhage.

(Richter). S. J. Fogelson, M.D.

Niess, B.: The Results of Gastric Resection for Perforation of Gastroduodenal Ulcer (Die Erfolge der Resektionen beim durchgebrochenen Magen- und Zwoelffingerdarmgeschwuer). Frankfurt: Dissertation, 1939.

The first gastric resection for perforated gastroduodenal ulcer was done by von Haberer in 1929. Surgical indications vary with different surgeons. Some resect those cases in which the perforation is six hours or at most twelve hours old; some are guided by the degree and extent of the peritonitis present; others are influenced solely by the general condition of the patient; while another school of surgeons believe resection the method of choice in every case.

From 1926 to 1937 in Schmieder's Clinic there were 111 patients operated upon for perforation. Surgical therapy consisted of 60 resections and 51 closures which were either simple closure or closure plus gastro-enterostomy.

Perforation occurred suddenly without any previous symptomatology as well as after years of digestive disturbances. In only 29 per cent of the cases did severe pain occur either immediately before or shortly prior to the perforation. This series demonstrated no relationship between the mortality and the duration of symptoms. The time interval between perforation and operative intervention was less than six hours in 40 patients; in 15 it was between six and twelve hours; and in 5 it was between twelve and twenty-four hours. In the remaining group in which the intervals were longer, good results were also obtained. There were 3 deaths in the group operated upon before six hours had elapsed after perforation and 1 death in the group operated upon before twelve hours had elapsed.

The time-interval alone is not the sole factor in the selection of cases for resection. The opinion of the various surgeons who discussed this paper differed on this point. Friedmann, Dreuter, Kuechel, and Richard favor radical intervention in the six-hour interval group but not after nine hours. Emphasis, however, was placed on the varying mortality reported after twelve hours. For example, Hoche and Morengo report the mortality rose from 0 in the early group to 80 per cent; Kunz from 2.8 to 18.7 per cent; Brueck from 12.8 to 59.7 per cent, and Mayerer from 11.8 to 40 per cent in 28 patients or 46.7 per cent, especially when marked peritonitis was demonstrable during the operation. In this group 13 patients had a localized peritonitis and 15 a diffuse peritonitis. If one correlates the degree of peritonitis to the time-interval in hours, it follows that in five and eight-tenths hours there is no evidence of inflammation, but in eight and two-tenths hours inflammation is localized and in eight and nine-tenths hours it is generalized.

The operative results do not necessarily seem related in any way to the intensity of the peritonitis. Patients with generalized peritonitis and a twelve-to-twenty-four-hour interval tolerated a resection well whereas 4, 1 of whom had only a limited localized peritonitis and 3 had practically no evidence of peritonitis, died.

There were 47 duodenal ulcers and 13 gastric ulcers, of which 3 were on the posterior duodenal wall. This made the operation very difficult. Four perforations were found to be covered. In two-thirds of the cases there was either a second ulcer or a gastric inflammation. This finding is very important

and is a basis for favoring resection following perforation. In addition, the patients do not become symptom-free after the palliative operation. A second operation at a later date is much more dangerous because of adhesions and because the patient's condition may be worse. The average duration of hospitalization was three and one-half weeks, and 19.6 per cent of the patients had postoperative complications such as lung inflammation, bronchitis, and circulatory failure. There were 2 incisional abscesses and 1 femoral thrombosis and embolus of the lungs.

Before any conclusions may be drawn it is necessary to contrast the mortality of both types of surgical intervention and to evaluate the mortality and results obtained by resection. The use of gastric resection in the therapy of perforated gastroduodenal ulcers has definitely not elevated the gross mortality and has certainly reduced it. Peters, for example, has in the past three years performed gastric resection in 85 per cent of his patients. Prior to 1929 his mortality was 80 per cent; this has been reduced to 7.6 per cent in 100 cases of perforation. In addition, permanent end-results have been much more satisfactory.

The original article contained tables on the mortality found at the different time intervals when resection was done. From the reports of the other surgeons discussing the subject a total mortality of 18.1 per cent was given for patients who were in good general condition and had a satisfactory circulation at the time of operation. One may therefore conclude that gastric resection following perforation is the method of choice because of the lower total mortality. That this mortality may be very low has been demonstrated by Yudin in 673 cases of perforation which were resected. He reported a mortality of 9.8 per cent, and in the last 121 cases it dropped to 6.6 per cent. The Frankfurt Clinic also reports good end-results. They had in all their patients a gross mortality of 22.5 per cent. The mortality for the group having had gastric resection for perforation was 6.7 per cent.

The final conclusion is that in properly selected cases of perforation resection is the operation of choice. SAMUEL J. FOGELSON, M.D.

Petri, S., and Jensenius, H.: Experimental Studies on the Production of Pernicious Anemia by Operation on the Digestive Tract. I. Survey of the Results of Total Gastrectomy and Resections of the Stomach. *Acta med. Scand.*, 1941, 84: 274.

After an extended series of experiments aimed at the possible production of pernicious anemia in dogs, swine, monkeys, and rats subjected to total gastrectomy or subtotal resection of the stomach, the chief results obtained were only various anemic states which depended on the animal species and the type of operative procedure. In none of the many experiments was pernicious anemia successfully reproduced. None of the animals showed simultaneous appearance of the typical characteristics: hyperchromic megalocytic anemia, hyperplasia of the bone marrow, and capacity for reaction to liver therapy.

In a few instances there appeared a blood picture somewhat resembling that of pernicious anemia. In gastrectomized pigs, however, there appeared constantly a severe, chronic pellagra which took a fatal course.

In the dog spontaneous anemia resulted in 78 per cent of the animals following total gastrectomy; in 59 per cent after subtotal gastrectomy or gastric resection; and in only 27 per cent after isolation of the stomach. In contrast to this, a state of anemia developed in 100 per cent of the dogs after resection of the fundus or pylorus. In the monkey only hypochromic anemia was observed. All animals seem to develop anemia more rapidly after total gastrectomy and fundus resection than after resection of two thirds of the stomach. JOHN W. NUZUM, M.D.

De Garis, C. F.: Topography and Development of the Cecum-Appendix. *Ann. Surg.*, 1941, 113: 540.

The appendix is frequently one of the mobile viscera of the abdomen. Its position depends largely on the cecum which varies in contour and position. These changes in the cecum are dependent on the type of cecum, as well as the peristaltic activity, the state of filling, and other physiological conditions at any given time.

Three general types of ceca occur:

1. Type A, with the infantile contour, in which the cecum is a pyramid with the appendix arising from the inverted apex.

2. Type B, found most frequently in the early years of childhood. There is a symmetrical growth-distention of the right and left sides with the appendix attached to the most dependent part of the cecum.

3. Type C, the usual adult form of cecum, in which there is a differential growth-distention in favor of the right ventral aspect of the cecum to such degree as to cause the appendix to arise distinctly to the left and dorsally. With excessive growth of the right wall of the cecum, the root of the appendix may lie close to, or even somewhat behind, the ileocecal junction.

The three types suggest a sequence of development from Type A, through Type B to Type C, dependent upon weight bearing and "growth-distention" of the cecum. The author advances the following hypothesis:

In the newborn the Type A cecum-appendix takes a position in the right iliac fossa. As the child assumes the upright posture, the weight-bearing function becomes increasingly important in shaping the cecum. Linear and lateral growth of the cecum, as well as of the remainder of the gastro-intestinal tract, occurs. Thus Type B is the result of weight-bearing and intrinsic growth. As weight-bearing and growth continue, a differential is set up in favor of the right wall of the cecum by reason of the ileocecal junction and by the blood supply of the appen-

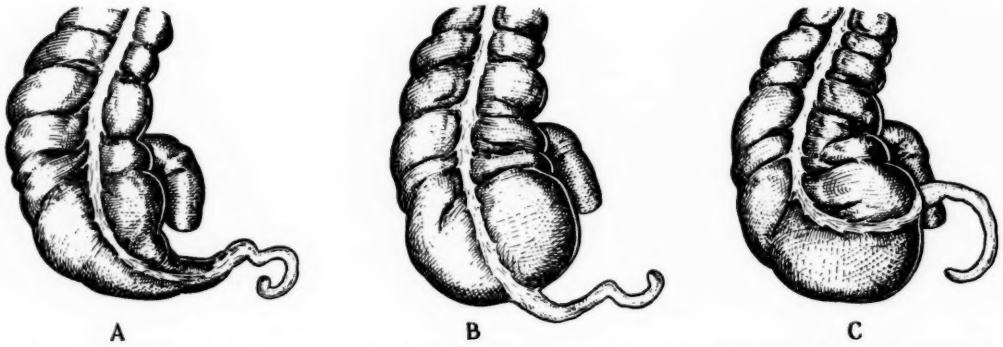

Fig. 1. A, The infantile cecum-appendix. B, The cecum-appendix during early years of childhood. C, The usual adult cecum-appendix, where the appendix arises dorsally and to the left as a result of growth-distention of the right ventral wall of the cecum. All three specimens are viewed from in front. (*Courtesy of J. B. Lippincott Co.*)

dix, both forming a drag or fixation for the left wall. This differential appears to operate largely as the result of weight-bearing and, once set up, is readily extended to produce the definitive Type C of the adult cecum-appendix.

The fact that in the undescended cecum the contour remains either as Type A or B, apparently because the usual weight-bearing of cecal contents is not a factor in shaping the contour, would seem to support the hypothesis.

The positions of the appendix may be classified into two categories:

1. The adherent retroposture (behind the colon, cecum, or ileum)
2. The postcecal or otherwise directed position of the fully mobile appendix

The descent of the colon from the liver to the iliac region is often attended in transit by a folding under of the appendix, which latter forms an inclusion behind the colon. If the appendix remains free and directed caudally during its descent, it may have great mobility provided pathological changes do not alter the situation. The variability in position of the appendix suggests the futility of giving McBurney's point a precise topographic definition; rather we should endeavor to find the point of greatest tenderness in appendicitis. JOHN A. GIUS, M.D.

Mason, M. L., Allen, H. S., Queen, F. B., and Gibbs, E. W.: A Review of 1,000 Consecutive Appendectomies. *Quart. Bull. Northwestern Univ. Med. School*, 1941, 15: 1.

This review is based on the records of 1,000 consecutive patients who were operated upon primarily for appendicitis of some degree over a ten-year period at Passavant Memorial Hospital, Chicago. The mortality rate for all cases was 1.3 per cent. These cases were classified according to the pathologist's diagnosis, supplemented by the surgeon's observations regarding the presence of peritonitis, abscess formation, or other findings which the pathologist could not evaluate from a study of microscopic sections alone.

The following groups form the basis for this classification: acute appendicitis, chronic appendicitis, fibrosis of the appendix, normal appendix, miscellaneous diseases of the appendix, and mistaken diagnosis of appendicitis. Complications and fatalities were most common among the cases of acute appendicitis with peritonitis or abscess formation, and in cases in which appendectomy was performed in the presence of other pathological processes found at operation to be the probable cause for the symptoms manifested.

There were 656 cases of acute appendicitis. In 582 of these the appendix was unperforated; in 15 there was perforation without peritonitis or abscess formation; in 40 there was peritonitis; and in 19 there was abscess formation. The mortality rate for all cases of acute appendicitis was 1.5 per cent. For the unperforated group the mortality was 0.5 per cent; with early perforation this figure rose to 6.7 per cent, with peritonitis to 10 per cent, and with abscess formation to 10.5 per cent.

Immediate operation is indicated in all cases of unruptured acute appendicitis, or when the appendix is reasonably suspected to be the cause of acute abdominal symptoms and cannot be ruled out. Immediate operation is indicated in all cases of appendical peritonitis, regardless of the time seen, except in the obviously moribund patient or the patient whose general condition precludes any operative intervention whatever. Conservative management seems justified only in that group of patients with appendical abscess or a definitely localized mass. If there is no response to treatment, drainage is indicated.

The age, sex, and seasonal incidence are discussed, and the relative frequency of the common clinical manifestations in each type of appendicitis are analyzed in detail. The authors attach considerable importance to a group of symptoms which they classify as "abdomen consciousness." When histories

are carefully taken it is often apparent that the patient with acute appendicitis has been aware of vague abdominal symptoms for one or two days before the onset of an acute attack. These symptoms are ordinarily forgotten or disregarded. The appetite may be diminished, there may be a mild feeling of fullness, and movements of gas, ordinarily ignored, may become perceptible. These symptoms are thought to mark the occurrence of minor changes in the appendix which precede the acute inflammatory process that produces grossly recognizable complaints. These minor pathological changes unaccompanied by striking symptoms may, in part, explain the unreliability of chronological criteria for determining the degree of appendical involvement.

The "classical" symptoms and signs of acute appendicitis are present in but a third of the patients. Pain was the most consistently observed symptom, not only in patients with acute appendicitis but also in those with chronic inflammation, fibrosis, or a normal appendix. Leucocytosis and fever were seen to depend in the main upon the degree of appendical involvement. However, an elevated white-cell count and a fever are not infrequently absent even in cases in which a markedly inflamed appendix is removed. Nausea and vomiting are slightly more common among patients with acute appendicitis than among those with chronic fibrosed or normal appendices. Abdominal tenderness is the most consistently demonstrable clinical finding in patients with acute appendicitis, but was also observed in a large number of patients with lesser degrees of appendical involvement. Involuntary abdominal rigidity, while not a consistent finding, was elicited in five times as many patients with acute appendicitis as with chronic appendicitis, fibrosis of the appendix, or normal appendix. It should be added that rigidity seems to be more frequently found by the experienced surgeon than by the less experienced one. Microscopic hematuria and pyuria are often seen in cases of acute appendicitis when the appendix is in a retrocecal position.

The McBurney incision was associated with a lower mortality rate and fewer postoperative complications than the right rectus incision. The advantages of the McBurney incision for acute appendicitis far outweigh any possible disadvantages, including the rare instances in which it is necessary to enlarge this incision or to close it and make a second more advantageous incision.

Of particular interest to the thoughtful surgeon is the relation of pre-operative skin preparation to postoperative wound infections in all undrained cases of acute unperforated appendicitis. Gentle, thorough soap and water cleansing of the abdominal skin was associated with fewer postoperative wound infections than attempts at sterilization of the skin with tincture of iodine, picric acid, or alcohol.

The authors believe that intraperitoneal drainage is indicated only when there is gross and foul-smelling exudate in the peritoneal cavity. The mortality rate in cases of peritonitis which were not drained was slightly lower than in drained cases, but the number of cases reported is admittedly too small to permit dogmatic conclusions.

The clinical manifestations and course of patients who were found to have chronic appendicitis, fibrosis of the appendix, or a normal appendix are discussed. There were no deaths among 52 cases of chronic appendicitis and 186 cases of normal appendix. There was 1 death in 76 cases of fibrosis of the appendix.

There were 9 cases of miscellaneous diseases of the appendix and 21 cases in which some other pathological process was found, at operation, to be the cause for the symptoms manifested.

EDWARD W. GIBBS, M.D.

Rose, T. F.: Retroposition of the Transverse Colon Complicated by Ileocecal Volvulus. A Report of 1 Case with Recovery, and a Review of the Literature. *Med. J. Australia*, 1941, 1: 225.

Retroposition of the transverse colon is a congenital condition in which the transverse colon lies behind the superior mesenteric vessels, and the third part of the duodenum is in front of them. In addition it may be accompanied by abnormalities of the third stage of midgut rotation. This is apparently the rarest anomaly of the second stage of bowel rotation.

The important predisposing factor of ileocecal volvulus in such cases is the retention of the primitive mesentery of the cecum, ascending colon, and hepatic flexure. The anomalous position of the transverse colon *per se* need not give rise to any sequelæ.

The case reported is that of a forty-three-year-old man with a three-day history of severe abdominal pain. The pain began in the left iliac fossa, radiated over the lower abdomen, and was colicky in nature. With each spasm of pain, distention of the abdomen occurred. There was no vomiting. No previous similar attack had occurred. The temperature and pulse rate were normal. On examination, the abdomen was distended and tender, especially in the right lower quadrant.

At laparotomy, it was found that the obstruction was caused by volvulus of the terminal ileum, cecum, ascending colon, and that portion of the transverse colon which lies to the right of the mesentery of the small bowel. Distal to the volvulus, the transverse colon disappeared through a tunnel in the mesentery of the small bowel behind the superior mesenteric vessels. The involved portion was greatly distended and of tissue-paper thinness, but was still viable. The volvulus was carefully untwisted and a cecostomy performed with a catheter. This was done to drain the distended small intestine and to form adhesions so that the cecum would become fixed to the iliac fossa and prevent recurrence of the volvulus. The tube was removed on the eighth postoperative day and complete recovery followed.

There were 11 other cases in the literature, 7 in females and 4 in males. The ages ranged from seven

days to sixty-eight years. There were no diagnostic symptoms or radiological signs indicative of retroposition of the colon. It was only with the onset of volvulus that the symptoms of obstruction appeared. The type of operation depended upon the viability of the bowel. Resection must be done if the bowel is non-viable. HAROLD LAUFMAN, M.D.

Gabriel, W. B.: Squamous-Cell Carcinoma of the Anus and Anal Canal; An Analysis of 55 Cases. *Proc. Roy. Soc. Med.*, Lond., 1941, 34: 139.

Gabriel presents an analysis of the cases of 55 patients with squamous-cell carcinoma of the anus and anal canal who were admitted to St. Marks Hospital during the period from 1922 to 1940. The incidence was 3.35 per cent of all cases of carcinoma of the rectum, anal canal, and anus. The sex distribution was equally divided between men and women and the average age of the patients was sixty-one and seven-tenths years, which is somewhat higher than that in columnar-cell carcinoma. The cases were graded into three grades of malignancy—low, medium, and high. Low-grade squamous carcinoma is twice as frequent in men as in women and generally originates at the anal margin. Medium-grade squamous carcinoma is equally distributed between the sexes, and it may arise at the anus or in the anal canal. High-grade lesions are much more common in women and are almost entirely limited to the anal canal. One-third of the anal margin growths and one-half of the anal canal growths were situated anteriorly. Differential diagnosis must be made from simple papilloma, simple ulcer, chronic inflammation, tuberculous ulcer, primary chancre, amebic ulcer, basal-cell carcinoma, and columnar carcinoma.

The results of treatment in the three grades of malignancy are described.The best results were obtained in the early low-grade cases treated by interstitial radium needling. In the medium and high-grade cases, only 3 five-year survivals can be reported and these followed excision of the rectum.

The necessity for gland dissection of the groins must be determined on a clinical basis. If the glands are enlarged to about 0.5 in. in diameter or more, if they are hard rather than firm or soft, metastases are probably present and block dissection of one or both groins should be done, according to indications. In the author's opinion, the best time for gland dissection (if there is immediate indication for this) is from two to three weeks after the treatment of the primary growth has been carried out.

Gabriel is opposed to the local removal of a gland for diagnostic purposes; if the glandular involvement is such as to arouse the suspicion of malignancy the only sound treatment is a formal gland dissection. If no glands are palpable in the inguinal regions, or if they are only small, clinically simple glands are present, and the groins should be watched. The author emphasizes the importance of this supervision for at least two and one-half years after operation, with personal follow-up. J. M. MORA, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Richards, R. K., and Appel, M.: The Barbiturates and the Liver. *Anes. & Anal.*, 1941, 20: 64.

In addition to a review of the more recent work regarding the relationship of the barbiturates to the liver, the authors present experimental data obtained with mice, rabbits, dogs, and monkeys. The problems discussed are not settled.

Although anatomical changes in the liver after the use of barbiturates have been described, and occasional clinical observations support the suggestion that liver damage may occur, barbiturates cannot be considered clinically as specific liver poisons even after repeated use. Transitory fatty infiltration of the liver, that can be partially inhibited by adequate preliminary treatment with dextrose, has been observed with many barbiturates. Thiobarbiturates should not, according to present knowledge, be used orally for chronic administration. When these drugs are used intravenously to produce anesthesia the danger of producing liver damage seems to be very slight. Barbiturates do not seem to impair metabolic activities of the liver, but the available data do not permit a definite statement as regards their possible effect on a diseased liver in which function is impaired or the ability to cope with these drugs is decreased.

Experiments of the writers support other studies which indicate that experimental liver damage does not influence the action of the long-acting barbiturates, such as barbital, but does cause a marked prolongation of the effect of the shorter-acting groups, such as nembutal. Support is also furnished to observations indicating that the liver does not play the same rôle in the inactivation of pentothal as it does with the other short-acting preparations. Mild liver damage due to fatty infiltration arising from dietary deficiency causes a tendency to prolong the action of all types of barbiturates; this is possibly due to impairment of the liver function or perhaps to retarded removal of the drug which has been absorbed into the liver fat.

WALTER H. NADLER, M.D.

Lucia, S. P., and Aggeler, P. M.: The Influence of Liver Damage on the Plasma Prothrombin Concentration and the Response to Vitamin K. *Am. J. M. Sc.*, 1941, 201: 326.

The relationship between the prothrombin concentration and liver function as determined by the hippuric-acid test was studied in 92 patients, 23 of whom had obstructive jaundice, 43 diseases of the liver, and 26 miscellaneous non-renal diseases. In addition, the values for the prothrombin concentration and hippuric-acid tests were determined after treatment with Vitamin K, in 25 patients, 11 of whom had obstructive jaundice, 12 diseases of the liver, and 2 miscellaneous non-renal diseases.

No significant correlation was found between the results of the liver-function test and the plasma

prothrombin concentration either before or after the administration of Vitamin K. Prothrombin concentration may be normal in patients who have severe impairment of liver function as measured by the hippuric-acid test. Plasma prothrombin concentration may become normal after the administration of Vitamin K even though the liver function remains severely impaired. Failure of recovery from hypoprothrombinemia cannot be correlated with the degree of impaired hepatic function.

Regardless of the results of function tests, the authors found that in the presence of acute liver disease the fluctuations in the prothrombin concentration are conditioned by the severity of the illness and are not ordinarily influenced by Vitamin K. In chronic, diffuse liver disease there may be a low prothrombin concentration, which is not usually influenced by Vitamin K. In obstructive jaundice there may be a low prothrombin concentration which usually can be significantly elevated with Vitamin K unless severe hepatic damage is also present.

WALTER H. NADLER, M.D.

Zollinger, R.: Acute Cholecystitis. *New England J. Med.*, 1941, 224: 533.

In the past, the treatment of acute cholecystitis generally included delay of operation until the acute signs and symptoms of the disease had subsided. Over a period of twenty years, 235 cases of acute cholecystitis were treated according to the above dictum in the Peter Bent Brigham hospital in Boston, with a mortality rate of 10.7 per cent.

Since that time, it was decided to follow the diagnosis of acute cholecystitis by immediate hospitalization. Pain is relieved, fluid balance established, and signs, symptoms, and laboratory data are evaluated frequently. The optimum time for operation depends on the patient's response to pre-operative treatment. Signs of progression of the inflammatory process in the right upper quadrant, or of general peritoneal irritation indicate early operation. Each patient is an individual surgical problem, and stereotyped management is unsatisfactory.

In 121 cases of acute cholecystitis treated by operation during the last five years according to the above plan, a mortality rate of 3.8 per cent was obtained.

These patients ranged all the way from those whose acute signs and symptoms had already subsided by the time of admission to those with a fulminating infection whose acute signs and symptoms increased in severity under conservative treatment. Such patients must be observed early and frequently in order that the most suitable time for operation can be chosen.

Twenty-five per cent of the patients in the series were operated on within forty-eight hours of admission to the hospital, whereas the remaining 75 per cent were hospitalized seventy-two or more hours before operation.

Perforation, which increases the mortality, occurred in 16, or 13 per cent, of the 121 cases, with a mortality of 6 per cent. Except in rare cases, the perforation is walled off by the omentum and adjacent tissue, and an extracholecystic abscess is formed. As a rule, persistent pain, increasing leucocytosis, and increasing local signs of inflammation under treatment imply that the gall bladder has perforated.

Postoperative complications were present in 20 per cent of the entire group; they were mostly pulmonary, wound infection being the second most frequent. Infection and pulmonary embolus were the chief causes of death. Advanced age was not considered a contraindication to surgery.

Cholecystectomy was performed in 71 cases, with a mortality rate of a little over 1 per cent, which is only a fraction higher than that for chronic cholecystitis. Choledochostomy was combined with cholecystectomy in 40 cases, with a mortality rate of 5 per cent. Common-duct stones were found in 20 cases, an incidence of 15 per cent, which is almost as high as that in cases of chronic inflammation. Cholecystostomy was carried out only in the severest cases, with a mortality rate of 11 per cent. This is always followed later by cholecystectomy, except in patients who are very poor risks.

Although improvements in postoperative care must receive credit for reducing the mortality, individualization of the treatment of the patient with acute cholecystitis is probably the most important factor.

S. LLOYD TEITELMAN, M.D.

Martensson, K.: Studies on the Etiology of Gall Stones. *Acta chirurg. Scand.*, 1941, 84: Supp. 62.

The current study on the etiology of gall stones is a sequel to the one published in 1937 entitled "The Incidence of Gallstones in Sweden. The Correlation of Gallstones with Various Diseases and Pathologic Changes." The present work consists partly of patho-anatomical, bacteriological, and chemical investigations on human material and partly of experiments *in vivo* and on animals.

A general survey on the composition of gall stones leads to the conclusion that gall stones can be classified as to the preponderance of structural elements such as pure pigment, cholesterol, calcium, and mixtures of these elements. Further study of the morphology would indicate that gall stones are made up of an organic stroma that holds the "stone elements" together. Attention is called to "cholesterinization" as described by Naunyn, Rosving, and Boysen. It would appear that many of the large stones begin as a pigment nucleus and as time lapses cholesterin is deposited.

A study of normal bile for sediment revealed no epithelial cells or structure resembling the latter and the conclusion reached is, "The epithelial cells proven to exist in the gallstones' centers therefore seems to indicate the existence of a pathologic process with epithelial desquamation during the first step of stone formation." An investigation of quantitative cholesterol and calcium determination of gall stones indicated that the relative as well as

the absolute quantity of cholesterol increases parallel with the gain in weight of the stones and that a cholesterinization in the chemical sense may take place in gall stones during their stay in the gall bladder.

An investigation of the stroma of gall stones revealed that it consisted almost entirely of solid, rod-shaped structures joined together into long threads and bundles and forming a veritable network. In the periphery these rods are gram-positive and often contain endospores. In the central areas the rods become gram-negative. These rods are termed the "typical bacilli." The conclusion is that all human gall stones have an organic stroma which at least in some cases is built up of formations resembling the tissue in the mucous membrane of the gall bladder and the so-called "typical bacilli."

A study of the symptomatology and pathology of the disorder of gall stones leads to the conclusion that in the largest percentage of cases the formation of biliary calculi proceeds without any symptoms of biliary disorder, the so-called "silent course," and that in most cases the cholecystitis, if present, is secondary to the gall stones. A study of the pathology of the liver, gall bladder, and biliary passages in the presence of gall stones shows little of significance relative to the etiology of gall stones. It was noted that in some geographic areas, such as Batavia, gall stones are rarely if ever encountered; however, if an inhabitant of such a geographic zone is transported to a region where gall stones are prevalent, such an individual will demonstrate a higher "morbidity" than the original inhabitant. It is deduced, therefore, that an environmental factor seems to play a part in the formation of biliary calculi. It was also noted that a chronic desquamative change in the mucosa of the gall bladder was found in practically all uncomplicated cases of gall stones.

The various theories of the etiology of gall stones were studied and investigated by clinical and experimental studies and the final conclusion reached that dietary disturbances, hypercholesterolemia, status or disturbances in motility of the biliary tract, and attenuated or virulent infection do not play a role. Likewise, general disturbances such as pneumonia, adiposity, pancreatic lipomatosis, adrenal lipoidosis, diabetes mellitus, hepatic hemosiderosis, chronic and healed tuberculosis, pernicious anemia, splenic and hepatic stasis, and testicular fibrosis were considered and discarded as etiological factors in the formation of gall stones.

An investigation was made of the bacterial content of bile, calculi, and feces in 78 cases of gall stones and of the bile and feces of cases without calculi. This resulted in the finding of gram-positive, motile, endosporulating rods in the first group, which were called "typical bacilli," and other commonly encountered organisms such as the bacillus coli and paracoli, staphylococcus albus, enterococcus-like diplococcus, bacillus welchii, and others. In 19 of the 78 cases both the calculi and the bile were sterile. The "typical bacilli" were found in 33 or 42 per cent, and these were the only bacteria in 17 cases or 21.8 per cent. Thin slices of pigment cholesterol gall stones, aseptically cut, were placed on von Magnus plates, incubated at plus 37°C., and examined at intervals by means of agar microscopy according to Ørskov. In several cases this yielded a growth of "typical bacilli" and occasionally the bacillus coli and cocci.

A study of the morphology and certain biological qualities of the "typical bacillus" shows that this organism does not fit into any of the bacterial groups described in text books. Two groups were identified: Type I, a facultative anaerobe, and Type II, an obligatory anaerobe. Type I is a straight or slightly curved rod with round ends that has a tendency to grow into long threads. It is actively motile. Spores appear within from twenty-four to forty-eight hours in agar culture. It hemolyzes human and rabbit blood. Type II grows only anaerobically and shows a scanty thread formation; otherwise it is essentially the same as Type I.

In experiments with fixation of the complement, antigen extracts of some gall stones gave fixation of complement with antiserum against "typical bacilli"; also the intracutaneous injection of 0.1 c.cm. of a clear antigen extract of "typical bacilli" gave an allergic reaction in several patients with gall stones.

Direct inoculation of "typical bacilli" into the gall bladders of 73 rabbits was followed by the formation of definite gall stones or preliminary forms in 55 cases. Formed bodies appeared within twenty-four hours, firm bodies as a rule in one week, and "stone-hard, grossly stratified bodies," as a rule, in about three months. Gall stones were produced experimentally also in swine, sheep, and cattle following the inoculation of "typical bacilli." The stones varied in size up to 1 cm. in diameter and all the types of gall stones seen in man were obtained. The "typical bacilli" were obtained in pure cultures from such experimentally produced stones. Rabbits that were immunized and then inoculated with "typical bacilli" in doses sufficient to produce gall stones did not develop calculi in from five to six months.

No matter in which way the inoculation of typical bacilli was done, it was always followed by a proteolytic desquamative mucosal process similar to that observed in the 2 cases, previously mentioned, of probably recent gall-stone formation in man. As a rule, this process was accompanied by a mild, inflammatory reaction in the form of hyperemia and edema in the submucosa and, in some cases, in the tunica fibrosa also, but there was generally extremely scanty or no round-cell infiltration whatever. At the same time there could be observed shifts in the pH of the bile, a reduction in the bile-salt content, and, finally, precipitates of pigment compounds and cholesterol, as well as of inorganic calcium, on the network of desquamated mucosal tissue and bacilli, which later constituted the stroma of the stone. These preliminary forms of calculi later increase in size and become stratified and stone-hard, at the

same time as reparative processes begin in the gallbladder wall, so that the latter eventually becomes practically normal or else shows only mucosal atrophy or hypertrophy, possibly accompanied by a slight increase in connective tissue in the submucosa and perhaps in the tunica fibrosa also. At the same time, the bile returns to its normal color and viscosity and becomes quite clear with a normal pH and a higher bile-salt content. We thus have the picture usually presented by uncomplicated cases of gallstone disease in man. Relapses may occur later, with the formation of new stones or increase in size of the old ones. On these occasions the typical bacilli can generally be demonstrated in the bile.

The evidence leads to the conclusion that an infection of the gall bladder with typical bacilli is not the only conceivable etiological factor in the formation of gall stones in man, and that certain mulberry stones may be formed because of the polypi in gall bladders in cholesterosis which store cholesterol until they become stone-hard, and then loosen from the wall; this takes place independently of the typical bacilli. JOHN A. WOLFER, M.D.

Ogilvie, R. F.: Duodenal Diverticula and Their Complications—Acute Pancreatic Necrosis. *Brit. J. Surg.*, 1941, 28: 362.

The author describes the clinical histories and post-mortem findings of 4 cases of perivaterine duodenal diverticula. In Case 1 the diverticulum produced obstruction and dilatation of both the pancreatic and common bile ducts, with resultant atrophy of the pancreas and death from obstructive jaundice. In each of Cases 2, 3, and 4 the diverticulum was associated with acute pancreatic necrosis, which favored the view that this disease of the pancreas is obstructive in origin.

In a review of the literature, cases are cited which illustrate the complications of duodenal diverticula. Although primary diverticula of the duodenum are relatively common, complications are rare. They are classified as obstruction, which may be that of the duodenum, of the common bile duct, or of the pancreatic duct; diverticulitis, which may be followed by perforation, peridiverticulitis, duodenitis, or cholangitis; calculi, which may be either enteroliths or gall stones; and carcinoma.

The association of a perivaterine diverticulum and acute pancreatic necrosis has been reported several times. All the phenomena of acute pancreatic necrosis are explicable on the grounds of an escape of pancreatic juice from the ducts into the surrounding tissues. Such an escape of pancreatic juice can occur only through destruction or rupture of the ducts or acini. This may be brought about by external trauma, focal infarction of the organ, infection with tissue destruction, retrojection of bile into the pancreatic duct with rupture of the acini, or pressure due to obstruction of the ducts from outside the pancreas or within its substance.

Most authors maintain that in the majority of cases pancreatic necrosis results from obstruction of the duct system of the pancreas. In some cases, this obstruction occurs in relation to the main duct and is due to a duodenal diverticulum, pancreatic calculus, or stone in the lower end of the common bile duct; but in most instances the obstruction is found in tributaries of the duct within the pancreas, and takes the form of a proliferative and transitional metaplasia of the lining epithelium. However, duct obstruction does not invariably provoke pancreatic necrosis, and such exceptions are probably due to inactivity of the secretory glands of the pancreas.

Duodenal diverticula are relatively immune to infection, probably because their contents are sterile; they are situated retroperitoneally, which permits ready distention; they have an inverted position and widemouthed ostia which allows free drainage into the bowel. However, once filled, they may not readily empty themselves, and stagnation of their contents favors bacterial growth, infection of the wall, and diverticulitis.

The reasons for the rarity of calculus formation in these pouches are probably similar to those which prevent the occurrence of diverticulitis.

Only 1 case has been reported in which malignancy occurred in association with the duodenal diverticulum. S. LLOYD TEITELMAN, M.D.

Kennard, H. E.: Papillary Cystadenocarcinoma of the Pancreas. *Surgery*, 1941, 9: 65.

Malignant degeneration of cysts of the pancreas is very rare, while papillary cystadenocarcinoma of the pancreas is probably exceedingly rare. Kennard reports a case of a female patient, forty years old, who for three or four years had noticed a swelling of the lower abdomen. Exploration revealed a large cystic mass which arose from the middle of the pancreas as a sessile tumor. The tumor was developed. A dissection was made through the tumor, the transverse mesocolon, and the gastrocolic omentum, and the tumor was removed and a defect about the size of a fifty-cent piece was left in the midportion and inferior margin of the pancreas. Histological examination revealed the tumor to be a papillary cystadenocarcinoma of the pancreas. The patient made an uneventful recovery and showed no evidence of recurrent malignant disease ten months following the operation; however, she had a mild persistent diabetes, which had not been present before the surgical intervention.

The author has reviewed the literature on pancreatic cysts in general with special attention to those cases of probably malignant cysts, of which he has found 25 in the literature. The ages of the patients varied from thirty-four to seventy-nine years; sex distribution was not significant. In most of the cases the symptoms were either abdominal pain or abdominal swelling of long standing in most instances, while only rarely was there rapid growth. The operative procedures varied from exploratory laparotomy and closure to drainage, marsupialization, and excisions. The operative mortality in the re-

ported cases was quite high, although if the patients recovered from operation they lived a considerable length of time. Two of them lived seven years, after which one died of a proved malignancy, and the other developed a malignant cystadenocarcinoma, which was excised. Only 1 other patient had a definite glycosuria.

The author does not state his opinion as to whether the malignancy was secondary to the cyst or whether it was primary. The relative incidence of malignant to benign pancreatic cysts is, according to Kennard, about 9 per cent. He believes that the only adequate treatment is complete excision of the tumor.

WILLIAM C. BECK, M.D.

MISCELLANEOUS

Ruggieri, E.: Abdominal Plethora in the Pathogenesis of the Acute Abdominal Syndrome of Pleuropulmonary Disease (La pletora addominale nella patogenesi delle sindromi addominali acute da pleuro-pneumopatie). *Clin. chir.*, 1940, 16: 637.

The author has studied experimentally the confusing clinical problem of the acute pseudosurgical syndrome in pleuropulmonary disease. He reviews the various theories that have been offered in explanation of this well known clinical phenomenon. The most recognized of these explanations is the neurogenous theory, that abdominal pain is due to irritation of certain nerve trunks, such as the intercostal, the phrenic, the vagus, and the ileohypogastric.

The author points out some discrepancies in this theory: namely, that the acute abdominal syndrome appears in chest conditions when none of these nerves can possibly be involved (parietal or mediastinal pleura); and states that if an inflammatory reaction in the nerve trunks is assumed, the sudden relief of these symptoms after a thoracentesis or aspiration would seem contradictory since it takes time for nerve tissue to heal and regenerate. The occurrence of a similar syndrome in cardiovascular diseases has led him to an interest in circulatory changes as a possible explanation of this syndrome.

Post-mortem studies on patients with acute chest conditions furnished the following data: in croupous pneumonia 55.7 per cent of the cases, in bronchopneumonia 66 per cent, in bronchopneumonia complicating pulmonary emphysema 100 per cent, and in spontaneous pneumothorax from pulmonary tuberculosis 80 per cent showed hyperemia of the liver and spleen. The author concludes that there is a hyperemia of the liver and spleen in many acute conditions of the respiratory apparatus. He suggests that the abdominal hyperemia may be correlated with the reduction in the respiratory area of the lung. In fact, he points out that in those conditions such as bronchopneumonia and spontaneous pneumothorax in which there is a marked reduction in the pulmonary area, there is an incidence of hyperemia in the liver and spleen amounting to from 80 to 100 per cent.

The author then studied the question experimentally in two series of animals. In a group of 8 rabbits he induced pneumothorax by various methods and then examined the abdominal organs macroscopically and microscopically. In this series the liver was markedly hyperemic. The portal vessels, the centrolobular veins, and the intralobular capillaries were markedly dilated. These changes were found throughout the liver parenchyma. The spleen showed dilatation of the veins and the centrofollicular arteries. There was also dilatation of the lacunar vessels of the reticulum. Subcapsular hyperemia was particularly apparent in the spleen. There was also marked hyperemia of the kidneys, especially in the vessels about the tubules.

In a series of 5 dogs the author attempted to determine what happened to the pressure in the inferior vena cava when a large area of the pulmonary tissue was involved. Under ether anesthesia a laparotomy was done and the inferior vena cava was connected with a glass cannula to a manometer. Three of these dogs died of hemorrhage. In the 2 others it was observed that opening of the pleural cavity resulted in dilatation of the inferior vena cava and an increase in the manometric reading. The liver, kidneys, and spleen showed the same hyperemic changes as were noted in the previous experiments on rabbits.

The author concludes that the theory of neurogenous irritation is not an adequate explanation of the pathogenesis of the abdominal syndrome in acute pleuropulmonary disease. Post-mortem and experimental studies have indicated that in acute affections of the respiratory tract there are circulatory changes of a mechanical nature in the splanchnic area with a resulting stasis in the inferior vena cava and intense congestion in the hepatoportal region. The latter changes are the cause of the abdominal syndrome in pleuropulmonary disease.

JACOB E. KLEIN, M.D.

GYNECOLOGY

ADNEXAL AND PERIUTERINE CONDITIONS

Strassmann, E. O.: The Theca Cone and Its Tropism Toward the Ovarian Surface, a Typical Feature of Growing Human and Mammalian Follicles, *Am. J. Obst. & Gynec.*, 1941, 41: 363.

This article is a report of microscopic work done over a period of eighteen years. It presents the "theca interna cone" and its tropism toward the ovarian surface as a new feature in the normal histology and physiology of the ovary. The theca interna cone functions as a pathmaker for the ascent of the growing follicle to the ovarian surface. It is, therefore, an integral part of the mechanism of ovulation.

The findings are based upon more than 18,000 microscopic serial sections of ovaries in four mammalian orders: primates (man), carnivora (dog, cat), rodentia (rabbit), and ungulata (horse, cow, swine), and they are illustrated by photomicrographs showing small, medium, and large follicles of various species.

The diameter of human growing follicles and their distance from the ovarian surface were measured micrometrically. Corresponding to the size, five groups of follicles were formed, and the average distance of each group from the ovarian surface was calculated. It was shown that in the early stages of follicular growth, up to a diameter of 0.25 mm., there was a descent of the follicles from the albuginea toward the hilus, and an ascent of the larger follicles back to the surface. This ascensus began with the appearance of the theca layers.

Examination of the theca layers in serial sections showed that their growth was an eccentric one. There was present a one-sided thickness of the theca interna, rich in cells, toward the ovarian surface, which in large follicles was from eight to ten times wider at the upper pole than at the lower pole toward the hilus. The theca externa, on the other hand, rich in connective-tissue fibers, was wide around the lower hemisphere of the follicle and thin at the upper hemisphere toward the ovarian surface. Thus, the theca externa, like a goblet, kept the follicle from expanding to any other side except to the surface of the ovary.

In serial sections cut perpendicularly to the ovarian surface, it was found that there was not only a one-sided blunt thickness of the theca interna, but a wedge-like "theca interna cone" with a triangular cut surface which always pointed to the nearest part of the ovarian surface. This theca cone possessed a tropism toward the surface like the sprout of a seed and plowed the path for the follicle by active infiltrating growth through the stroma and albuginea. The follicle proper followed the line of least resistance provided by the theca cone. The granulosa protruded into the cone, and frequently adopted the shape of a cone itself, the axis of which always coincided with the axis of the theca cone.

The theca cone was found in all the mammalian species examined, including man. In all the mammalian species with a free ovarian surface, the theca cones grew divergently toward the next point of the ovarian surface. In horses, in which the ovaries were surrounded by connective tissue, the theca cones grew convergently toward the only free spot, the "ovulatory pit." This proved that the theca cone fulfilled the purpose of bringing the follicle to that part of the ovarian surface where ovulation can take place.

Geometrical considerations showed that the theca interna cone could be demonstrated as a triangular-shaped wedge only in serial sections which were cut perpendicularly to the ovarian surface and which ran through the apex of the cone. Sections cut in any other direction would never reveal the theca cone as a wedge-like formation. This must have been the reason that it was not found before in the ovary, an organ which has been studied by many research workers for several generations.

The theca interna cone was present in actually growing follicles only. It disappeared as soon as degeneration took place. It, therefore, can be used as a test for gonadotropic hormones. Rupture of the follicle was useful as a qualitative test but, if combined with hemorrhage, showed overdosage of the gonadotropic hormones. The theca interna cone can be useful as a quantitative test, as it shows the various degrees of stimulation before ovulation occurs. It, therefore, should become useful for determining the physiological dosage and timing.

EDWARD L. CORNELL, M.D.

Orsós, F.: Obliterating Hematosalpinx (Haematosalpinx obliterans). *Ztschr. f. d. aerztl. Fortbild.*, 1940, 37: 551.

A sixteen-year-old virgin was ill for four months with pain in the right lower quadrant of the abdomen, vomiting, and fever. She had been menstruating since her fifteenth year but had menstruated only twice, the last period having occurred a month ago. The gynecological examination revealed a fluctuating tumor the size of an ostrich egg which originated in the right adnexa. The uterus and adnexa could not be palpated separately. At the operation a bicornuate uterus was found and a thickly swollen, brownish red tube which lay in a coagulated mass of blood confined by the omentum. The tube and the right cornu of the uterus were removed, and uneventful recovery followed. The tortuous tube was filled with chocolate-brown, thick fluid. Histologically the tubal lumen was filled with blood clot consisting in greater part of desquamated and invaded cells, but which also contained unchanged red blood cells. The greater part of the cells were

disintegrated. The intact cells were filled with distorted red blood cells and granular blood pigment. The clot was partly organized. Four very good illustrations show the individual changes in the specimen. A bicornuate uterus with a poorly developed mucosa, and a partly organized hematosalpinx were found. The clinically palpable tumor was formed on the one hand by the swelling of the right tube, and, on the other, by the blood which had leaked out of the tube and the adherent limiting omentum. It is evident that the author was dealing with the menstruation of a bicornuate uterus with a poorly developed infantile mucosa. However, it was difficult to decide whether the blood was from a menstruating tube or whether it leaked into the tube from the right cornu.

The author decided that it was the former as this seemed more plausible and more natural. The fact that menstruation had occurred twice showed that the cervical canal was not closed. Although inflammation of the pelvis could definitely be excluded, nevertheless a secondary closure of the tubal ostium occurred. The occurrence of a so-called tubal labyrinth without inflammatory origin was not proved and could not be considered. Nevertheless, the author presented a short review from the literature.

All changes in the ampullary part of the tube undoubtedly resulted from the two menstruations of the tube, from the stagnation of the blood in the tube, and from the spillage of the blood into the surrounding tissue. That the blood originated in the tube itself and not in the uterus was proved by the intact condition of the left tube and the increased enlargement of the ampulla: the interstitial and isthmic portion of the tube did not take part in the enlargement. Whether there really was a definite menstrual bleeding of the tube or a cyclic bleeding, it was impossible to state. Therefore, a definite tubal closure can occur without bacterial inflammation of the tube and be due to developmental changes in the tube and the resultant stagnation of blood.

(Rudolph Heemeyer). Leo A. Juhnke, M.D

Løvset, J.: Subsequent Investigations of Patients Operated upon at the Clinic from 1928 to 1938 for Sterility Due to Tubal Occlusion. *Acta obst. et gynec. Scand.*, 1940, 20: 344.

Of 77 patients operated upon for occlusion of the tubes, 9, or possibly 11, became pregnant within the next five years. Two stated they had aborted, but they cannot be included as proved pregnancies. Of the 9 indisputable pregnancies, 2 were ectopic, and 7 went to full term. All cases had bilateral tubal closure demonstrated by hysterosalpingography and verified at operation. There were no pregnancies in the 20 patients who had had gonorrheal or tuberculous pelvic disease. One of 6 patients who had had induced abortions became pregnant, 1 of 5 who had had spontaneous abortions, 2 of 14 who had been infertile for from one and one-half to fifteen years after childbirth, 2 of 7 who had had appendicitis, and 1 of 21 in whom the etiology and pathogenesis were unknown. Of 4 patients who had had endometriosis none became pregnant.

Insufflation is performed during the operation and at least once before the patient is discharged. The author has constructed an insufflater, on the end of which is a small balloon. This latter is inflated after it is within the uterus, and thus makes an airtight closure of the cervix. E. S. Burge, M.D.

EXTERNAL GENITALIA

Berven, E. G. E.: One Hundred and Seventy-Seven Cases of Primary Carcinoma of the Vulva (177 Faelle mit primaerem Vulvakarzinom). *Acta radiol.*, 1941, 22: 99.

Carcinoma of the vulva includes carcinoma of the labia majora and minora, of the clitoris, and of the posterior commissure, but not carcinoma of the urethra. Implantation or contact metastases are frequent, but most metastases follow the lymph routes to the superficial inguinal and the deep inguinal lymph nodes, Rosenmueller's body, and the iliac lymph nodes. Bilateral metastases are frequent, even from small primary tumors. Most carcinomas of the vulva are squamous-cell carcinomas, but adenocarcinomas occur; they originate from sweat glands, sebaceous glands, mucous glands, or Bartholin's glands. Medullary or papillomatous cancers are rare. Metastases appear early. Vulva carcinoma is chiefly a disease of the old; most of the cases are found in the seventh and eighth decades of life. Death usually occurs within from one-half to one year after onset of the disease, and is due to general cachexia with metastases, chronic sepsis, secondary pyelonephritis, pulmonary embolism, and hemorrhages from eroded femoral vessels.

The results of surgical treatment are generally inconstant and disappointing. Permanent cures were obtained in from 5 to 36 per cent of the cases, according to different reports. The mortality figures vary from 10 to 15 per cent.

Radiological treatment, according to a statistical survey by Stoeckel, resulted in cure in 12 per cent of the cases.

As to combined irradiation and surgical treatment, there are not enough statistics to allow definite conclusions. Of a small group of 24 patients of Cahen, 7 (29 per cent) were permanently cured by preliminary radium treatment, followed by vulvectomy, and later radical extirpation of the inguinal and iliac lymph-nodes.

From 1910 to 1913 in the Radiumhemmet in Stockholm, Sweden, 8 cases of carcinoma of vulva were treated radiologically, all with poor results. From 1916 to 1921, a slightly modified technique was used. Of 30 cases 20 per cent resulted in primary cure, and 13 per cent in permanent cure. Due to the high doses of irradiation, there were marked undesirable side effects, such as atrophy of the mucosa and necroses. After 1922, the Radiumhemmet began to use irradiation with electro-surgery, which method represents the main subject of this article.

During the years from 1922 to 1935, 177 cases of primary carcinoma of the vulva were treated by electrocoagulation in the Radiumhemmet. Sixty-seven additional cases in which only palliative measures, such as teleradiumtherapy, could be used are also considered in this report. Sixty-one per cent of the patients were sixty years or more, while 33 per cent were seventy years or more. In the majority of the cases, a chronic atrophic vulvitis preceded the carcinoma. The duration of the carcinoma before admission was usually less than one-half year, or one year at the most. Ulceration and secondary infection occurred early and produced malodorous and bloody secretions, or cystitis. No active treatment had been done on these patients before they were referred to the Radiumhemmet, except occasionally a biopsy, which according to Berven is undesirable unless done in immediate conjunction with the main operation.

In 124 patients the primary tumor was localized on the labia, in 38 on the clitoris, and in 15 on the posterior commissure.

Berven subdivides his cases into 4 groups according to local involvement. Group I contains tumors which occupy only a part of the vulva, and are not ulcerated. There were 13 of such cases, of which 11 (85 per cent) were without symptoms after five years or more.

Group II contains tumors which also are localized on only a part of the vulva, but are ulcerated. The secondary infection frequently led to inflammation of the regional lymph nodes. There were 52 patients in this group, of which 23 (44 per cent) were symptomfree after five years or more.

Group III contains tumors which had spread to neighboring parts of the vulva by continuity or by contact, and those which had a twofold site primarily. This group was made up of 73 patients, 24 of which (33 per cent) were symptomfree five years or more after treatment.

Group IV contains tumors which had spread beyond the vulva. Of the 39 patients in this group, 7 (18 per cent) showed a cure of five years or more.

According to the presence or absence of metastases, the following 3 stages are differentiated.

In Stage I the lymph nodes were either normal or inflammatory, i.e., enlarged but soft. Of the 81 patients with this finding, 48 (59 per cent) were symptomfree five years after treatment or longer.

In Stage II the lymph nodes were enlarged and hard, with perinodal infiltration: they probably already contained metastases. This type was found in 70 patients, and 16 of them (23 per cent) lived and were well five years after the treatment.

In Stage III the lymph nodes were enlarged, hard, immobile, and almost certainly presented inoperable metastases. Of 26 patients with this finding, 1 was symptom-free five years after treatment.

The diagnosis which led to the classification of 81 patients as being in Stage I was found wrong by histological study or in the further course of the condition in only 15 cases (20 per cent).

The diagnosis was verified in all but 6 cases by histological examination, and in these 6 cases the clinical course left no doubt that the diagnosis was correct.

Pre-operative medical treatment often helps to improve the result, e.g., bronchitis, cystitis, and pyelitis should be treated carefully before operation.

Necrotic tumors should be prepared by hygienic measures, or by resorption treatment with the roentgen rays.

Anesthesia was formerly induced with chloroform; now evipal-sodium is used intravenously, and usually only 2 to 5 c.cm. of the 10 per cent solution is required.

The electrosurgical operation can be done with any modern instrument. Either one small electrode locally with a large one on the abdomen or on one arm are used, or bipolar active electrodes. After superficial coagulation, the tumor masses are taken between two migratory electrodes and destroyed. Also the apparently tumorfree parts of the vulva are destroyed in this manner. One proceeds from above downward, from the clitoris towards the commissure in order that ascending hot steam will not produce indeterminable damage in the untreated areas. The depth of coagulation is governed by the findings gained from occasional incisions with a plain scalpel, especially near the symphysis. Especial care is necessary around the urethra which sometimes may have to be destroyed up to the external sphincter. Undue heating and carbonization is prevented by constant irrigation of the field with cold water. In tumors close to the rectum, a small piece of ice inserted rectally serves to protect the rectal mucosa. The operation takes from three to ten minutes; hemorrhages are rare and easily controlled by coagulation.

Postoperatively, there is almost no pain. In the second and third weeks the coagulated tissues are demarcated, and frequent irrigations with potassium permanganate are needed to cleanse the area. Secondary hemorrhages are also controlled by coagulation. After three weeks, there is a clean granulating area, and the patients get up. During demarcation, there may be some fever, from 38 to 39°C. Healing is complete four or five weeks after the operation, and the patients are then discharged. The scar after this treatment is soft, non-adherent, usually non-shrinking, and there are no keloids. There were 10 deaths (6 per cent) in the author's series postoperatively; 7 of the patients died of pulmonary embolism, and 3 of pneumonia.

Berven believes that the tumor cells are especially thermosensitive and quotes experimental evidence in support of this belief.

The regional lymph nodes have been treated with teleradium exclusively since 1929, while from 1922 to 1929 roentgen rays were used also. In each groin, two fields of about 5 cm. in diameter are centered, one medially, to include the lymph nodes around the large vessels, and one laterally 6 or 7 cm. to the side. In Stage I, the patients get from 2700 to 3600

roentgens within twelve or sixteen days. In the Stages II and III 3600 roentgens are given. Occasionally additional roentgen treatment is given through a dorsal field. The reactions are moderate, and if ulcerations occur, they heal in the sixth week after the treatment. Close supervision within the first half-year will indicate whether secondary irradiation is advisable.

Surgical extirpation of the regional lymph nodes was done rarely, only in 38 of the 177 cases reported. Radioknife surgery was disappointing in this procedure in 3 cases, and therefore was abandoned in favor of the cutting knife. Lymph-node extirpation was limited to the superficial and deep inguinal nodes. There was usually poor healing after the radium and roentgen treatments. Therefore a new technique was developed in 1934: Hybbinette, the surgeon collaborating with Berven, began to remove the skin, subcutis, and superficial and deep inguinal lymph nodes *en bloc*, and to close the skin wound primarily with Thiersch grafts. The results were good; only 5 of the 38 patients treated surgically in this manner died from the operation. In 3 of the 38 patients, no metastases could be found microscopically in the removed nodes. Thus only 35 patients can be considered in evaluating the permanent cure. Six were symptomfree after five years or more.

HEINRICH LAMM, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Voege, A., and Schneehagen, H.: A Contribution to the Question of the Intra-Uterine Transmigration in Tubal Pregnancy (Ein Beitrag zur Frage der inneren Ueberwanderung bei Tubengraviditaet). *Zentralbl. f. Gynaek.*, 1940, p. 1912.

After a detailed survey of previous publications relating to this subject, the authors state that intra-uterine transmigration in tubal pregnancy has never before been definitely proved. They report a case of their own which proves the occurrence of this phenomenon on the basis of histological studies.

A woman, aged twenty-eight years, whose right adnexa had been removed previously for ectopic pregnancy, underwent a second laparotomy on the suspicion of another extra-uterine pregnancy. The rupture was found in the adnexal stump at the right edge of the uterus, while the solitary left ovary contained the corpus luteum of pregnancy. Serial sections of the excised right uterine cornu showed an open tubal lumen with well preserved mucosa, and a lumen even behind the site of the rupture, although here the mucosa had already become defective. However, ½ cm. from the end of the stump, the lumen became indistinguishable. The authors believe it impossible that a previously open stump had recently closed. They assume on the basis of histological studies, several of which are published in the original article, that there was a true internal transmigration from the left ovary into the open lumen of the stump of the right tube.

(Volk). Heinrich Lamm, M.D.

Kisimoto, S., Okai, K., and Yorihudi, T.: Intra-Abdominal Hemorrhage from Spontaneous Rupture of a Subserous Blood Vessel of the Uterus During Pregnancy. *Jap. J. Obst. & Gynec.*, 1940, 23: 238.

A case is described in which a massive intra-abdominal hemorrhage, due to the rupture of a subserous vein in the posterior wall of the uterus, occurred in the ninth month of pregnancy. The patient was a thirty-year-old para-iv. Her previous obstetrical experiences had been uneventful. She had twins and hydramnios. Under the diagnosis of premature separation of the normally implanted placenta, the abdomen was opened. Dead twins were removed from the uterus. After the true diagnosis had been determined, the uterus was removed. The patient recovered. Eleven similar cases found in the literature are reported briefly.

No case exhibited a hemorrhagic diathesis, nor was external violence a factor. In all of the cases the hemorrhage was due to spontaneous rupture of a vein, possibly because of fragility of the venous wall. Some of the cases were accompanied by varices elsewhere. Overdistention of the uterine wall may also be a factor; it was present in the authors' case as well as in several others. All but 2 cases occurred in multiparas. In 3 cases the hemorrhage occurred in the eighth or ninth month of pregnancy. In the remaining cases, it took place at the time of labor. In most cases the rupture occurred on the posterolateral wall of the uterus.

The symptoms vary with the degree of the hemorrhage, but usually there is a sudden sharp pain in the abdomen, followed by pallor of the skin, a rapid, weak pulse, difficulty in respiration, coldness of the hands and feet, cyanosis, apprehension, and signs of acute anemia. The abdomen and uterine wall become distended and tense, which makes the palpation of fetal parts difficult. There is intense pain.

Not one of the cases in the literature was clinically diagnosed as such, but the true diagnosis was revealed by operation or autopsy. Most of the cases were diagnosed as premature separation of the normally implanted placenta. There is no satisfactory means of distinguishing between the two.

The prognosis is unsatisfactory. Eight of the 12 mothers died; also, the severity of the hemorrhage usually results in the death of the fetus.

Rupture of a blood vessel can be treated by suture following cesarean section. However, if it is desirable, Porro's operation may be performed. This procedure would depend upon the condition of the uterus. the position of the rupture, and the age of the patient. Daniel G. Morton, M.D.

Neuweiler, W.: Polyneuritis during Pregnancy (Polyneuritis in der Schwangerschaft). *Med. Klin.*, 1940, 2: 1179.

Polyneuritis is quite a frequent complication of pregnancy if its numerous mild forms are taken into consideration. The extremities are principally involved, the region of the ulnar and median nerves, but the regions of the sciatic and the peroneal nerves and of the sacrum are often attacked, while neuralgia of the face is much more infrequent. In addition to these neuralgic disturbances, a decrease in sensibility up to complete loss of sensation may occur in the neuritis of pregnancy, and even symptoms of paralysis may be observed, although they are quite rare according to the experience of the author. The disease picture usually sets in during the last third of pregnancy, but it is often found in the beginning of pregnancy, and is generally accompanied by hyperemesis. In fact, the severest forms of polyneuritis, which appear frequently in combination with Korsakoff-like psychoses, are observed especially in the presence of serious hyperemesis. Their prognosis is very grave and they show a mortality of 25 per cent.

The polyneuritis of pregnancy is considered nowadays as due to a Vitamin B_1 deficiency. It seems that at times the increased Vitamin B_1 demands of

pregnancy (the requirements of the child), at others a deficient Vitamin B_1 intake resulting from unfavorable dietetic conditions such as an increased carbohydrate intake, and diet poor in vegetables (the so-called protecting diets) play a part in the origination of the hypovitaminosis. In addition, special changes in the gastro-intestinal tract and in the function of the internal organs, such as are often observed in pregnancy and which may result in impairment of resorption, may also lead to Vitamin B_1 deficiency. Certain diseases, such as pyelitis, may have a similar influence during pregnancy. The relations of Vitamin B_1 to the nervous system are very intimate, and the disease picture of polyneuritis is accepted as an intoxication of the nervous system caused by abnormal products of metabolism, such as, for instance, pyroracemic acid and probably also other substances.

The results of the treatment of true polyneuritis of pregnancy with Vitamin B_1 preparations are extremely favorable. The prophylaxis recommended in healthy pregnant women consists mainly of the administration of an appropriate diet, and the diet must be specially watched in cases of hyperemesis. In the actual treatment with Vitamin B_1 preparations, it is recommended to give high doses, at least 10 mgm., but as a rule from 20 to 30 mgm. are given, at first intravenously and later intramuscularly in combination with aneurin tablets. The simultaneous injection of suprarenal-cortex preparations to increase the processes of resorption and of phosphorylization in the organism has proved to be useful. The experience of the author shows that, as a rule, healing occurs in 80 per cent of the patients; however, recurrences, which are then refractory to Vitamin B_1 treatment, are not infrequent.

(Neuweiler). Richard Kemel, M.D.

LABOR AND ITS COMPLICATIONS

Cornell, E. L.: Objections to Induction of Labor in Normal Pregnant Women. *Am. J. Obst. & Gynec.*, 1941, 41: 438.

For the purpose of this article a series of 200 consecutive normal pregnant women were studied. Data similar to those used by other authors in an effort to influence the medical profession to interfere with pregnancy at or near term were secured. All patients who presented signs of toxemia or of any of the accidents of labor were eliminated. The average age of all was twenty-eight and six-tenths years at delivery. There were 91 primiparas and 109 multiparas. The average weight of all the babies was 3,507 gm. The largest baby weighed 4,515 gm., and the smallest 1,814 gm.

Twenty five babies weighed 4,000 gm. or more, and they were about equally divided in the groups to be described.

The delivery dates being known and the expected term dates being computed the 200 patients were divided into four groups: (A) those who delivered in the interim between seven days before term and the expected term; (B) those who delivered in from one to seven days past the expected term; (C) those who delivered eight and fifteen-hundredths days after the expected term; and (D) those who delivered sixteen days or more after the expected term.

The number of babies weighing over 4,000 gm. averaged about the same in Groups A and B, around 10 per cent. In Group C the percentage was raised to 15 per cent and in Group D to 33 per cent. It is true, therefore, that babies carried past the expected term are larger. Most of the babies (151) weighed from 3,000 to 4,000 gm. There were 5 babies that weighed less than 2,500 gm. Only 1 baby weighed more than 4,500 gm., a percentage of 0.5 which compares with the findings of Koff and Potter (1.94 per cent in 20,219 deliveries at the Chicago Lying-in Hospital). There is a wide variation in the weights of babies delivered by normal women. The most marked differences were in the group of patients who delivered from seven days before term to term. Here the smallest baby weighed 1,814 gm., and the largest 4,400 gm., and no mistake was made in the reckoning by the patient or the physician. The pediatricians who examined the large babies hesitated to say definitely that any of them were postmature. There was no fetal or maternal mortality in this series, and, so far as known, all the babies are alive and well at this time.

From observation and a review of this series, the author firmly believes that physicians are not justified in interfering with the natural processes of pregnancy and labor in normal women. He protests against such a procedure.

Wiessmann, A.: Labor in Contracted Pelvis (Die Geburt beim engen Becken). *Ztschr. f. Geburtsh. u. Gynaek.*, 1940, 121: 331.

The author presents a detailed report on labor with contracted pelvis in an obstetrical series of 11,329 deliveries, of which 20 per cent were associated with contracted pelves as determined by exact pelvic measurements. After a detailed discussion of the mechanism of labor in contracted pelves and the technical procedures in the conduct of such labors, the author presents a classification of contracted pelves as to grade and severity.

In 15 of 1,150 women with contracted pelves of the first degree (with a conjugata vera of more than 9 cm.) which comprised 54 per cent of all the contracted pelves, a cesarean section was done; and in 1 multipara a symphysectomy was necessary. The percentage requiring surgical intervention was therefore 1.4. The cause of fetal death in contracted pelvis of the first degree is due less to the contracted pelvis than to other complications, so that this consideration need not interfere with the watchful waiting, conservative attitude in this condition. There was no difference in the results of labor in the generally contracted and in the flat rachitic pelvis, in the cases with first-degree contraction. In 3 deaths there was no particular reason for blaming the contracted pelvis or the conduct of labor for the mortality.

Twenty-five per cent of all contracted pelves belong to the group with second-degree contraction, and 30 per cent of these present an insurmountable obstacle to labor. Cesarean section had to be performed in 19 per cent of the generally contracted pelves, in 21.5 per cent of the flat rachitic pelves, and in 35 per cent of the generally contracted flat pelves. In the generally contracted flat pelvis there is no need to sub-classify the second degree of contracted pelvis since normal spontaneous birth may occur with a conjugata vera under 8 cm. if the fetus is not too large; spontaneous birth is not uncommon with a conjugata vera between 8 and 8.5 cm.

Also in the other types of pelves a further subclassification is not necessary. There was no essential difference in the course of labor with generally contracted pelves from labor with flat rachitic pelves if the conjugata vera was the same. With a conjugata vera of from 8.1 to 8.5, spontaneous delivery occurred in 60 per cent of the cases whether there was a flat rachitic pelvis or a generally contracted pelvis. In the cases of generally contracted pelvis of Group I it was necessary to do 10 forceps deliveries for asphyxia in the presence of persistent transverse position. In Group II this was not observed.

Grade III of contracted pelvis occurred 4 times in the generally contracted pelvis and 30 times in the flat rachitic pelvis. On 1 occasion a symphysiotomy followed by version and extraction resulted in a living child. In 29 cases cesarean section was done and only one child was lost because of cord strangulation and another died because of poor vitality. One mother died of acute cardiac failure. Contracted pelvis of Grade IV occurred only in flat rachitic pelves. There were 4 such cases which were treated by cesarean section without harm to mother or child.

Transversely contracted pelves occurred in 321 cases (15.1 per cent). In the latter group the need for operative interference is greater than in other types. In the cases of transversely contracted pelvis (to which group the sport-pelvis belongs) cesarean section averages 14.4 per cent and forceps extraction 21.8 per cent. In a group of 25 genuine funnel pelves cesarean section was done 8 times (the interspinous distance in these was less than 7 cm.).

Particularly unfavorable are the conditions in the generally contracted pelvis when there is transverse contraction at the outlet. The flat rachitic pelves with transverse contraction at the outlet are more favorable, since the transverse narrowing is not so extensive because of rachitic changes in the pubic bones. In the pelves with osteomalacia as well as with pseudo-osteomalacia the deformity is so extreme that the mechanism of labor is impossible.

In the cases with a flat rachitic pelvis of Grade I there were 3 face presentations with spontaneous delivery, and of Grade II a face presentation and a forehead presentation. One child was born spontaneously in facial presentation in the presence of a generally contracted pelvis. For the proper conduct of labor it is necessary that every patient with a contracted pelvis presenting a conjugata vera less than 9 cm. be admitted to hospital supervision although correct estimation of this condition and exact diagnosis may be very difficult. In the primipara the internal testing and palpation of the pelvis should be performed from four to six weeks before the termination of labor. In multiparas the history readily gives an indication of the previous difficulties and such women are accustomed to seek special care early as the result of such previous experience. In the presence of any abnormal position of the fetus (transverse or oblique) or malposition of the head in the presence of any degree of pelvic contraction special obstetrical supervision is necessary.

In the contracted pelvis of Grade I spontaneous delivery should be encouraged and operative intervention should be used in the cases in which a large fetus has been carried past term and there is considerable malproportion of the parts (1.4 per cent). In Grade II of contracted pelvis it is most difficult to decide on the conduct of labor since about half of the cases may deliver spontaneously. The decision in Grades III and IV of contracted pelves is easy since these cases always require cesarean section. Conservative management of labor has demonstrated that many more of these cases may deliver spontaneously than has been hitherto suspected. In the conduct of labor we must be aware now that the maternal mortality in such cases cannot be improved very much; it is now 0.75 per cent, or 16 deaths in 2,115 deliveries. Perhaps there may be an improvement in the maternal mortality from improvement of the operative technique according to Doerfler. The entire fetal mortality including all dead, macerated, and moribund fetuses delivered at the clinic among a total of 2,115 deliveries was 114, barely 5 per cent. The fetal mortality has been 2.5 per cent.

This study demonstrates the correctness of expectant conservative therapy of labor in contracted pelvis. (H. WINKLER). JACOB E. KLEIN, M.D.

Sheldon, C. P.: Pelvic Delivery under Local Infiltration Anesthesia. *New England J. Med.*, 1941, 224: 404.

Sheldon, of the Harvard Medical School and the Boston Lying-in Hospital, reports a technique of delivery under local anesthesia with 1 per cent novocaine, which he concludes was "eminently satisfactory" in 64 cases. He describes the nerve distribution in the female perineum and external genitalia and shows diagrammatically his technique of local infiltration through five wheal sites to block the branches of the inferior hemorrhoidal, the ilio-inguinal, the pudic, and the small sciatic nerves. He advises as to proper novocaine preparation and equipment to carry out the procedure. The labor is conducted under analgesic agents in order to facilitate delivery under local anesthesia. Nitrous oxide is administered with each pain in the latter part of the first stage and "until the baby's head strikes the pelvic floor."

The author believes the routine discussed gives the most satisfactory results in normal and low-

forceps deliveries. Also "spontaneous breech deliveries, manual rotation of the head, Scanzoni's operation, the delivery of face and brow presentations after flexion, and even mid-forceps deliveries can often be conducted under local infiltration anesthesia." WILLARD G. FRENCH, M.D.

PUERPERIUM AND ITS COMPLICATIONS

Arbogast, W., and Embacher, E. M.: The Treatment of Puerperal Tetanus. The Report of a Cured Case (Die Behandlung des Tetanus puerperalis. Mitteilung eines geheilten Falles). *Zentralbl. f. Gynaek.*, 1940, p. 1650.

A thirty-one-year-old woman who had hitherto had 2 normal pregnancies was admitted to the Ludolph-Krehl Clinic in November, 1939, on the suspicion of tetanus. The usual family history was essentially negative. Ten days before admission the patient had performed a vaginal irrigation with soap and water after a cohabitation; she had used a rubber bulb syringe with a metal connecting tube for this purpose. She had done such vaginal irrigations for years. After this last irrigation there was a considerable amount of bleeding which continued more or less until the day of admission to the hospital. Eight days after the douche the patient was unable to move her jaws. On the next day there was a spasm of the muscles of mastication that rendered speaking and chewing impossible. On the tenth day the jaws could not be opened any more and there was a progressive stiffness of the neck, so that the attending physician advised immediate hospitalization.

No external wound was seen. Since there was no doubt as to clinical tetanus a lumbar puncture was performed under avertin anesthesia. At this time 12,500 units of tetanus antitoxin were administered intramuscularly and intraspinally. The patient was admitted to the women's ward since a genital infection was considered most likely according to the history. On bimanual examination the uterus was found to be definitely enlarged and soft. In the absence of other wounds or pathology a uterine infection was suspected and under avertin anesthesia a vaginal hysterectomy was done. Examination of the preparation revealed an ulcer the size of a penny in front of the internal os. The endometrium showed scattered remains of decidua. Animal tests were positive. In twenty days the patient received 720,000 units of tetanus antitoxin. Of this amount 177,500 units were given intraspinally and 542,500 injected intramuscularly. In eighteen days of treatment the patient had received 128 gm. of avertin.

(THEO PUETZ). JACOB E. KLEIN, M.D.

NEWBORN

Thompson, W. B., and Krahulik, E. J.: Resuscitation of the Newborn. *West. J. Surg., Obst. & Gynec.*, 1941, 49: 169.

The various modes of resuscitation are discussed. Four hundred and eight of 2,007 newborn babies received one or more types of resuscitative efforts. The methods of Sylvester, of Byrd and Dew, and the Schultze swing are mentioned and condemned.

Mouth-to-mouth breathing is the oldest mode of resuscitation available and it still remains a method of distinct value. Too strenuous blowing must be guarded against for fear of rupturing alveoli or of distending the stomach. Immersion offers no advantage over the maintenance of body heat with warm blankets, and with occasional sensory stimulation by slapping the buttocks or soles of the feet. It is probable that the restoration of a pink color to the skin of the infant immersed in hot water is due, not to improved circulation, but to a capillary dilatation in the skin itself. Tubs, in the opinion of the authors, should be relegated to the bathroom.

In numerous writings, Yandell Henderson has urged the employment of oxygen and carbon dioxide in restoring the respiratory impulse. When tracheal intubation is not performed, this may be done with an intranasal catheter. Administration through the nasal catheter is preferable to any type of mask. The application of Henderson's teachings is shown in that 92.6 per cent of the apneic babies received 5 per cent carbon dioxide in oxygen. Carbogen is the most available of modern treatments, and richly deserves the wide usage which it enjoys.

The tracheal catheter has come into wide usage. Two approaches in its employment are available: the first is by the sense of touch; the second is visual and requires the use of the laryngoscope. Suction is then applied to remove mucus and fluid before insufflation of the air or carbogen is begun. Once the catheter is inserted, air, carbogen, or oxygen may be introduced at will. The main caution to be observed is that only low pressure should be employed, not exceeding 4 to 5 mm. of mercury.

It is believed that alphalobeline acts by reducing the threshold of the respiratory center to the existing carbon-dioxide tension in the blood stream. It increases the depth of respirations and their frequency, but the authors have seen little effect, if any, prior to primary respiratory effort. Coramine, also, has been proposed as an aid in apnea neonatorum. Its value is questionable.

Adrenalin is disappointing, but it may have influenced the ultimate outcome in 2 of 8 cases. The authors have had no experience with the various mechanical types of respiration apparatus. They doubt their value.

The deeper grades of analgesia are responsible for the majority of the babies that need resuscitation, but no one routine was sufficiently represented to warrant a specific analysis. However, analgesia is a valuable advance in obstetrical ministrations and should not be ruined by abuse.

One hundred and sixty-seven cesarean sections were performed. In 55 of these, with 56 babies, resuscitation was necessary. The authors have noted a rather frequent disinclination to breathe among babies following section. A narcotic is not given pre-operatively, but 3 gr. of pentobarbital are ad-

ministered two to three hours prior to the scheduled operation. Despite this moderation, a considerable number of the babies are decidedly apneic at delivery. This may have been due to the anesthetic agent used, usually cyclopropane.

Resuscitation of the premature baby presents additional problems. With any appreciable shortening of the period of gestation, a marked immaturity of the respiratory reflex is apparent. Oxygen requirements increase directly with the degree of prematurity. The importance of removing fluid and mucus from the trachea is stressed. This should be secured by immediate resort to the tracheal catheter. The effect of analgesics upon premature babies is especially marked. Therefore, the safest conduct of a premature labor omits the use of analgesia.

The need for early attention to the newborn has been vastly increased by operative procedures and the widespread use of analgesics. By and large, the more potent sedatives result in apneic babies. The intelligent employment of carbogen and the intratracheal catheter is a necessity if present methods of sedation are not to fall into disrepute. Cesarean babies and premature babies demand special care.

DANIEL G. MORTON, M.D.

Brander, T.: The Frontal Fontanel Bone (Os Fonticuli Frontalis) and Its Clinical Significance; Report of a Case (Ueber den Stirnfontanellenknochen [Os fonticuli frontalis] und dessen klinische Bedeutung anlaesslich eines observierten Falles). *Acta obst. et gynec. Scand.*, 1940, 20: 372.

Brander gives the first survey of the literature on the frontal fontanel bone. While there are numerous reports from anatomists, there are very few from clinicians. Yet there is some clinical importance of this rare anomaly. Of the 3 cases of which clinical observations were reported previously only 1 did not end fatally. The frontal fontanel bone occurs about once in 200 newborn babies. Its usual shape is that of a rhombus. It originates probably from an atypical primary center of ossification. As its incidence is higher in cases of hydrocephalus, it appears as though it had the biological task of filling in abnormally large fontanels. Whether there is a hereditary cause is unknown. Clinically it may lead to a wrong diagnosis of the presentation of the fetal head before parturition. Also, fetal birth injuries may be more frequent in children with fontanel bones because of lesions of the sagittal superior sinus due to the irregular piece of bone. As the fetal head with a fontanel bone may be less plastic than a normal head, dystocia may be more frequent in these cases than usual. Premature cranial synostosis, according to some authors, may be due to fontanel bones and lead to tower head.

Brander reports a case. A primipara, aged thirty, delivered a baby boy of 2,950 gm. after a fairly normal pregnancy in head presentation. The delivery was normal except for long duration, and a vaginal tear. Two and one-half weeks thereafter the boy showed slight asymmetry of the facial innervation, but otherwise the neurological and spinal-fluid study was negative. There were cephalhematomas above both parietal bones. The frontal fontanel contained a bony plate 3 by 4 cm. in size. There was premature ossification noticeable soon thereafter, and after about one-quarter year the fontanel bone had formed synostoses with both the parietal and frontal bones. Only the anterior corner of the fontanel was still soft. At eight months, the boy was slightly rickety, had a mild bronchitis, but neurologically and developmentally appeared normal. The skull was very narrow.

In this case no internal examination had been made during delivery, thus there was no chance for a mistaken diagnosis of presentation, but even after birth the palpatory findings were baffling. The mother had an outspoken tower head.

HEINRICH LAMM, M.D.

MISCELLANEOUS

De Snoo, K.: Pregnancy, Labor, and the Puerperium in the Macacus Cynemalgus (Schwangerschaft, Geburt and Puerperium bei Macacus cynemalgus). *Nederl. Tijdschr. v. Verlosk.*, 1940, 43: 173.

The author investigated pregnancy, labor, and the puerperium as well as the regeneration of the uterine mucosa after parturition in 18 Java monkeys. The position of the fetus was determined with x-rays, and films were made of the uterine contractions during labor with the abdomen opened, the normal birth being filmed. Post-partum involution was followed, and the changes of the uterine mucosa during pregnancy, as well as its regeneration in the puerperal uteri, which were removed on the first, second, third, fifth, sixth, tenth, thirteenth, and seventeenth days days and studied serially. The number of head presentations increased with the duration of pregnancy. In only 1 instance was a breech presentation observed at the normal termination of pregnancy. Labor itself was witnessed only twice because the monkeys delivered at night and also because the first betrayal that they are in labor occurs when they have bearing-down pains. They generally devour the placenta. There were a few false and premature labors and 1 instance of retained placenta with putrefaction, much as occurs in the human being.

The uterine contractions are not peristaltic. The pelvis becomes roomier through the relaxation of the joints. The inlet is long-oval, and the posterior wall is made up of the short sacrum and the very movable tail, which is displaced backward during labor. The vaginal introitus is round and lies directed toward the rear; therefore, the birth canal is not curved as in man but straight. In the cervix there are present several small and two large ridges with fine appendages that are very firm and shut off the uterine cavity. The ridges lose their firmness during labor, first the lower and then the upper ones. At the same time the entire cervix softens and permits the passage of the fetus. As in the human being the dilation of the

cervix is preceded by a relaxation of the fuchsinophile tissues. During pregnancy a lower uterine segment is formed from the part of the cervix above the uppermost ridge. Because of the distention caused by the growing embryo the muscle wall acquires a laminated structure in the last months of pregnancy, which provides a normal solid foundation for labor. During pregnancy a decidua develops with compact and spongy components. The decidual cells and glands degenerate to a much lesser degree than in the human being. The placenta is composed of two parts, the larger portion with the umbilical cord lying on the anterior wall, and the smaller portion on the posterior wall. Rather marked variations exist, however. The placenta is hemochoreal, the intervillous space receiving its blood from the large arterial sinuses.

After delivery the sinuses thrombose and with the uterine contractions and involution they arch more and more into the lumen of the uterus until during the first day after delivery they are expelled with the rest of the decidua. On the thirteenth day the first signs of regeneration are plainly visible and on the seventeenth day a well developed, thick, normal mucosa is present. Evidently regeneration does not take place from retained cells of the decidua but occurs as in the human being, from hitherto undifferentiated cells. Thus there is a very close resemblance between the pregnancy, labor, and puerperium of man and those of the macacus.

These facts would indicate that the generative processes in man have changed but little since the branching off of the lower monkeys from the common aperistaltic stem, that is, since the upper eocene period. In the opinion of the author the lower monkeys originated from primitive two-footed animals, which sought safety in the trees and adapted themselves to a life in these trees. One of the results of this mode of life was that the upper extremities were no longer free, and the cerebrum did not develop further as in the two-footed animals. Nevertheless, the monkey has a large head at birth with a large brain just like the human infant, in fact, it is larger than that of the infant. This indicates that the large head of the newborn has nothing to do with the intellect, but is primarily concerned with the insurance of a normal head position and a safe normal birth. (De Snoo). John L. Lindquist, M.D.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Campbell, M. F.: Injuries of the Kidneys. *Surg. Clin. North Am.*, 1941, 21: 443.

Injuries of the kidney are relatively common and are always grave. The mortality varies from 3 to 40 per cent. The patients are predominantly men, and one-fourth of them are children.

The classic history of injury to the loin or upper trunk followed by pain, hematuria, shock, and sometimes perirenal hematoma and/or anuria, at once suggests renal injury. Excretory urography will suggest the correct diagnosis in 2 of 3 cases, but when this method is not entirely satisfactory, retrograde pyelography is demanded. The surgeon should be prepared, however, to operate immediately following the instrumental investigation and pyelography. Conservative renal surgery is the aim, but nephrectomy will be required in at least 2 of 3 cases of severe injury. Moreover, the patient should not be allowed to die either from the attempt to make a precise anatomical diagnosis or to repair a kidney that should be removed. JOHN A. LOEF, M.D.

Lowsley, O. S., and Menning, J. H.: The Treatment of Rupture of the Kidney. *J. Urol.*, 1941, 45: 253.

Traumatic rupture of the kidney has taken on added significance in recent years because of the increased automobile, sport, and industrial accidents. The old idea of watchful waiting if the hematuria is not excessive has been modified by the authors, who believe that with improved surgical technique the conservative thing to do is to perform an exploratory operation and stop the bleeding with a pad of fat held in place by means of ribbon-gut. The authors have proven to their satisfaction that adequate approximation and an anatomical repair was secured by the use of ribbon-gut in an animal experimental study, which they describe.

From a review of 82 cases of rupture of the kidney, the authors conclude that any patient with a history of trauma who has hematuria for more than twenty-four hours should have an exploratory operation, as this is now considered much more conservative than hopeful waiting. D. E. MURRAY, M.D.

Campbell, M. F.: Ureterocele. *J. Urol.*, 1941, 45: 598.

Ureterocele is a congenital obstructive lesion in which secondary urinary infection is the important complication. The resulting persistent pyuria, too commonly designated "chronic pyelitis," is the symptom which almost always prompts the urological diagnostic investigation.

Ureterocele is not unusual; it was observed in 1 of 30 cases of chronic urinary infection in children. It is notable that failure to identify ureterocele in the young sometimes accounts for premature death. For this reason the true incidence of the condition is doubtlessly lower in the cases of adults than in the young.

The clinical picture is almost always that of "chronic pyelitis." and urinary backpressure pain may be a prominent symptom. The diagnosis is readily made by urological examination. Urography is frequently helpful, especially when the ureterocele produces a cystographic filling defect.

Removal of the obstruction is the immediate treatment. The lesion is excised transurethrally with the McCarthy prostatic resectoscope and the cutting loop progressively removes large segments of the flabby ureterocele wall. Bleeding is controlled by coagulation. Eradication of urinary infection, calculi, or other complicating lesions is the essential accessory therapy. JOHN A. LOEF, M.D.

Spence, H. M.: Stones at the Ureteropelvic Junction. *J. Urol.*, 1941, 45: 579.

The author reports 24 cases of stones at the ureteropelvic junction. Urography showed functional or anatomical damage to the kidney resulting from the stones in 23 of the 24 cases. Except for diagnostic purposes, the use of cystoscopic procedures was ill-advised in this group. This was strikingly brought out in the synopsis of the fatal cases. Early surgical removal of the stone at the ureteropelvic junction is the treatment of choice.

JOHN A. LOEF, M.D.

BLADDER, URETHRA, AND PENIS

Kimbrough, J. C.: The Treatment of Bladder Diverticulum. *J. Urol.*, 1941, 45: 368.

This article presents a study of the treatment of 30 patients with diverticula of the bladder.

Three hundred and seventy-five patients were treated by operative procedures for obstruction of the bladder neck. The incidence of diverticula was 8 per cent. This report includes only true diverticula that have intact muscular walls lined with modified bladder mucosa. Saccules and shallow depressions, due to the outward protrusion of the mucosa between hypertrophied muscle bundles, have not been considered.

It is universally agreed that obstruction of the bladder neck except in the very rare congenital type, is essential to the formation of diverticulum, the "blow out" effect described by Keyes. Because of the small percentage (5 to 6 per cent) of the cases of bladder-neck obstruction that develop diverticula of consequence, it is evident that there are definite factors of "soil preparation" always present in the bladder wall. The back pressure must be present over a period of several years, for the formation of the sac is a slowly progressive process. Prostatic hyperplasia with varying degrees of fibrosis and median bars accounted for the obstruction in 22

cases in this series. Bladder-neck fibrosis without apparent prostatic enlargement was present in 8 cases. Urethral stricture was an etiological factor in 2 cases. The family history was significant in only 1 case: that of a patient fifty-eight years old whose father and one brother had been treated for prostatic hyperplasia and diverticula. Forty-three cases of prostatic carcinoma were seen, only 2 of which were complicated by diverticula.

Age incidence was as follows: patients up to and including those fifty years of age, 4 cases; from fifty-one to sixty years, 9 cases; sixty-one to seventy, 14 cases; seventy-one to eighty, 2 cases; and more than eighty years, 1 case.

The symptoms were those of prolonged obstruction at the bladder neck with the associated results of infection. The intensity of the disturbance was directly proportional to the extent and severity of the cystitis. In no case was there evidence leading to a diagnosis of diverticulum on symptoms alone. It appears that the obstruction in these cases had been present over a period of several years. The residual urine varied from 50 to 3,000 c.cm.

Symptomatology and physical examination offer little to indicate the presence of diverticula. The cystogram gives the most accurate information relative to the size, location, and number. Cystoscopy confirms the degree of obstruction, the number, size, location, and the relation of the ureteral orifices to the diverticular openings. The importance of cystoscopic examination is equaled only by cystographic data.

Three of the author's cases were complicated by bladder calculi. Two cases of carcinoma were present. In 1 patient, the ureteral orifice was located within the lower aspect of the diverticulum. Ureteral regurgitation and hydronephrosis were demonstrated on cystographic examination. One case of urethral stricture and ruptured diverticulum was noted in the series. A case of bladder tuberculosis with diverticulum at the fundus was present. The tuberculosis apparently had healed with bladder-neck fibrosis.

The rational method of treatment resolves itself into three distinct phases.

1. Measures to improve the general health and to eradicate bladder infection; this is accomplished by urethral catheter drainage, bladder irrigation, and by suprapubic cystostomy.
2. Surgical removal of the diverticulum.
3. The treatment of the bladder neck or urethral obstruction; this is accomplished by (a) dilatation, (b) transurethral resection, (c) prostatectomy, perineal or suprapubic.

Indications for operative removal are: (1) diverticula complicated by tumors or calculi; (2) large diverticula, especially in young men, which cause ureteral stasis or urinary retention; (3) diverticula that harbor persistent infections; and (4) diverticula that retain urine after the bladder-neck obstruction has been corrected.

Recommended operative procedures for the removal of diverticula are:

1. Intravesical diverticulectomy, described so splendidly by Young several years ago, is at its best in treating small multiple diverticula, especially those densely adherent to the adjacent tissues.
2. Transvesical resection has been employed in cases similar to those selected for intravesical approach, except that larger adherent sacs are more readily removed by this method. Intravesical incision is made around the circular neck and the sac is delivered into the bladder by traction on the free pedicle. The insertion of traction sutures into the margin of the bladder wall before the incision is made facilitates closure of the mural defect. Perivesical drains are placed communicating with the area of excision in this procedure. This method has been used in 3 cases, and for removing one of the sacs in a patient with multiple diverticula.
3. Extravesical excision has been employed in removing the large sacs. It is the operation of choice in all cases except those of small multiple diverticula. Seventeen cases have been corrected by this method, and it has been combined with transvesical excision in 1 case.

The following general principles of the operative procedure are emphasized:

1. Adequate preparation should be carried out. The patient should attain the best general physical condition, and the local bladder infection should be eradicated so far as practicable.
2. Safe anesthesia should be employed. Spinal anesthesia (novocaine not exceeding 100 mgm., held at a level of the umbilicus) has been the best.
3. Midline suprapubic incision should be made with adequate bladder mobilization without urinary contamination of the adjacent tissues. It is often necessary to divide the urachus. It is usually desirable to mobilize the bladder before it is opened.
4. Vasectomy prior to, or at the time of, operation will prevent the annoying incidence of epididymitis.
5. Ureteral catheters should be inserted before an attempt is made to separate the sac. It is more satisfactory to carry out the ureteral catheterization after the bladder is opened than to precede the operation by preliminary cystoscopy.
6. Select the best method or combination of methods suitable for each case, intravesical, transvesical, or extravesical approach.
7. Adequate drainage of the extravesical space for a period of five or six days is necessary except in the removal of small diverticula by the intravesical technique.
8. Adequate closure of the bladder wall at the site of the excision of the sac should be practiced.
9. Suprapubic cystostomy drainage should be maintained until the vesical neck obstruction is corrected.
10. Allow an ample time interval between the diverticulectomy and the removal of the obstruction at the bladder neck. In our series the average time between operations was forty-seven days.

The author performed a prostatectomy in the cases of 14 of 30 patients with associated bladder

neck obstruction for the relief of the urinary obstruction. Thirteen of these operations were done by the suprapubic approach and 1 by the perineal. In 9 patients the bladder-neck obstruction was relieved by transurethral resection. JOHN A. LOEF, M.D.

Micheletti, G.: Total Inversion of the Bladder; a Pathogenetic and Clinical Contribution (Inversione totale della vescica; contributo patogenetico e clinico). *Policlin.*, Rome, 1940, 47: sez. chir. 481.

Total inversion of the bladder is rare and is the gravest manifestation of the complex series of displacements of this organ. In the literature of the past fifteen years, Micheletti has found only 5 cases of inversion through the urethra and 9 through a fistula; he adds a personal case to the latter.

At the age of forty, a woman suffered a vesicovaginal fistula and a third degree laceration of the perineum on the occasion of a severe labor and manual delivery of a large fetus. She refused surgical repair. On admission at the age of sixty-eight, examination showed the presence of a large vesicovaginal fistula, total prolapse of the uterus and of the vaginal wall, marked posterior enterocele and partial prolapse of the rectum due to complete laceration of the perineum. She was submitted to two interventions: in the first the vesicovaginal fistula was repaired and the uterine prolapse temporarily reduced; in the second, one month later, the perineum was restored. The result of the interventions was good.

This case is interesting because the development of the lesions followed a different course from that considered classical and presented the following sequence: cystocele, rectocele, prolapse of the uterus, and posterior enterocele. In fact, the anamnesis revealed that the patient developed incontinence of urine seven days after the traumatism, prolapse of the rectum two months later, prolapse of the uterus after twelve years, partial prolapse of the bladder after twenty-five years, and total inversion of the bladder after twenty-eight years. It should also be noted that, in the few observations on the mechanism of inversion of the bladder, the inversion started in the anterosuperior or posterosuperior wall of the bladder and the trigone was exteriorized last and much more rarely than the other parts.

In the present case, the grave perineal laceration and the vesicovaginal fistula located on Pawlik's triangle served to interfere with the usual course of the disorder; the location of the fistula close to the ureteral orifices markedly reduced the pressure which the bladder exerts normally on the anterior vaginal wall. At the menopause with its natural loss of fat and its senile atrophy, when the already labile equilibrium between the intra-abdominal pressure and resistance of the pelvic floor was destroyed, the weakest point was the posterior vaginal wall, and the prolapse of the uterus in the present case started with a rectocele. The constant presence of two nodules, which protruded from the fistula and were the ureteral protuberances of the trigone, and the absence of symptoms of urinary retention proved that the inversion started with the extrusion of the trigone.

The mechanism of formation of the inversion becomes clear when it is compared to that of a hernia: the traction of the genital prolapse relaxed the natural connections of the trigone and the upper part of the vagina, all the more so as a portion of the latter was already missing because of the presence of a large vesicovaginal defect. Following the descent of the vaginal wall, the posterior part of the trigone which was the first to lose its natural adhesions found an artificial opening and engaged into it; as the traction became gradually stronger, the supporting and fixing apparatus of the bladder was reduced to the limits of its possibilities until a sudden increase in the abdominal pressure transformed the partial inversion into a total one.

The prognosis of this case was rather unfavorable from the surgical point of view because of the age of the patient and the presence of a serious unilateral pyonephrosis. The case serves to define more exactly the etiopathogenesis and the clinical picture of inversion of the bladder, of which there are two forms: one occurring by invagination and the other by a slipping of the bladder through a natural or artificial orifice. RICHARD KEMEL, M.D.

GENITAL ORGANS

Campbell, E. W.: The Significance of Hypertension in Prostatism with Chronic Urinary Retention. *J. Urol.*, 1941, 45: 70.

A group of 173 patients with prostatism, carefully observed, is the basis of this study of bladder decompression. Patients with acute retention were catheterized and drained completely at once. The patients with chronic urinary retention were divided into two groups; those with a low systolic blood pressure (below 160 mm.) and those with a high systolic pressure (over 160 mm.). The fall of blood pressure during decompression in those with low pressure was negligible. In those with high pressure decompression was carefully controlled to avoid the sudden drop so frequently seen in uncontrolled drainage. Decompression allows gradual stabilization of the blood pressure, and is an important factor in preventing the development of pyelonephritis.

In this series of 173 patients with prostatism only 19 had hypertension. In explanation, the theory is advanced that the hypertension in these patients occurs because of the inability of the upper urinary tract to dilate; this is due to an anatomical factor, an intrarenal pelvis. ANDREW MCNALLY, M.D.

Lowsley, O. S., and Kilgore, R. N.: Total Perineal Prostatectomy; A Modification of a Previously Published Technique. *J. Urol*, 1941, 45: 196.

The authors present a method of performing total perineal prostatectomy which gives unusually good exposure of the operative field, and makes it pos-

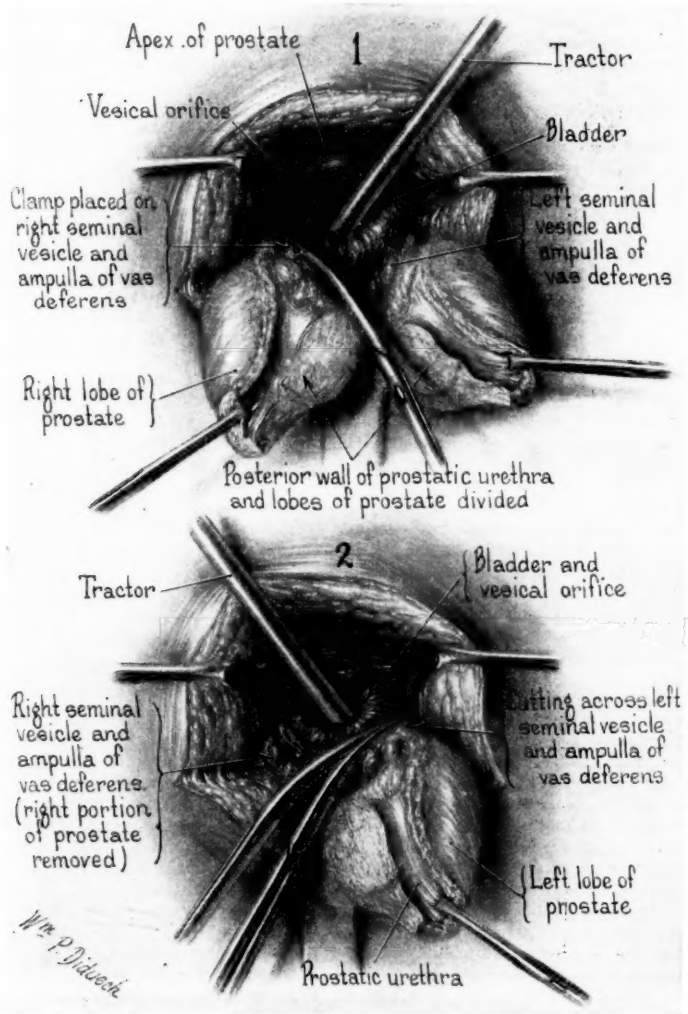
Apex of prostate
1
Tractor
Vesical orifice
Bladder
Clamp placed on right seminal vesicle and ampulla of vas deferens
Left seminal vesicle and ampulla of vas deferens
Right lobe of prostate
Posterior wall of prostatic urethra and lobes of prostate divided
2
Tractor
Bladder and vesical orifice
Right seminal vesicle and ampulla of vas deferens (right portion of prostate removed)
Cutting across left seminal vesicle and ampulla of vas deferens
Left lobe of prostate
Wm. P. Didusch
Prostatic urethra

Fig. 1. *1*, A clamp is placed across the right seminal vesicle and ampulla of the vas deferens. *2*, The right lateral lobe of the prostate and part of the median lobe have been removed. A clamp has been placed across the left seminal vesicle and ampulla of the vas deferens, and the left half of the prostate is being removed. (The vesical orifice and the urethra are then repaired in the manner previously described by Lowsley.)

sible to dissect the prostate gland from the bladder with a minimum of trauma to the vesical sphincter. The ability of the internal sphincter to contract is not destroyed and incontinence does not occur.

Bleeding vessels are clamped and ligated, which makes the use of hemostatic bags and gauze packing unnecessary.

The wound heals with a minimum of drainage, and the patient's postoperative hospitalization is shortened.

The procedure is not applicable to cases of suspected or known carcinoma of the prostate gland, but in certain cases of benign hypertrophy, calculosis, and other pathological conditions of the

prostate, in which removal of the gland and its capsule is indicated, this method of performing total perineal prostatectomy offers definite advantages.

D. E. MURRAY, M.D.

Mathé, C. P.: Thrombo-Angiitis Obliterans (Buerger's Disease) of the Spermatic Arteries; Report of a Case. *Transactions of Western Section, Am. Urological Ass.*, 1940, 9: 16.

The report of a case of thrombo-angiitis obliterans of the spermatic artery is submitted. This exceedingly rare condition occurred in a patient on whom orchidectomy was performed for painful swelling of the left testis.

There is no doubt that many cases of thrombo-angiitis obliterans of the spermatic vessels have been overlooked. Thrombosis of the spermatic vessels is usually confused with tuberculous epididymitis or malignant disease of the testicle. Spontaneous infarction of the testis and that resulting from torsion of the testicle is well recognized, but that occurring from thrombo-angiitis obliterans of the blood vessels of the testis should be borne in mind when a differential diagnosis of diseases of the testicle and spermatic cord is made.

Stasis, trauma, dependency of the limbs, locomotion, change in activity of the circulation, as well as age, sex, thermal influences, and the use of tobacco, have been considered predisposing factors which bring about the thrombotic and atheromatous occlusion of Buerger's disease.

Disturbances in the circulation which are produced by extensive obturation of the blood vessels are due to an occluding coagulum or to organization of the connective tissue. Certain pathological changes due to progressive inflammatory processes which take place in the perivascular tissues, as well as in the adventitia, media, and intima of the blood vessel, regularly accompany the obturating process associated with thrombo-angiitis obliterans. There is thickening of the intima, the media, and the adventitia, together with cellular infiltration and vascularization, whenever thrombosis occurs. The occluding mass frequently terminates abruptly in an apparently normal portion of the vessel involved. To begin with, there is acute inflammation, followed by purulent foci, and finally by thrombosis, organization, and canalization; thus all the morphological changes that go on in the process of healing are presented.

The authors emphasize the fact that thrombo-angiitis obliterans of the testicular vessels occurs and this should be borne in mind when a differential diagnosis of diseases of the testicle is being made. Tuberculous epididymitis is usually accompanied by tuberculous lesions in the seminal vesicles, kidneys, or bladder, the finding of which will aid in its recognition. Malignant tumor of the testis may often be differentiated by the employment of the hormone tests now in use for the diagnosis of this disease. Gumma due to syphilitic infection can be ruled out by an adequate clinical examination, including serological tests. Hydrocele of the cord usually transmits light, while spermatocele should give little trouble in its correct diagnosis. The hard mass due to infarction may occur in the epididymis, cord, or the testis proper.

Quantitative determination showing an increase of adrenalin in the blood has been a diagnostic aid in Buerger's disease. In cases of thrombo-angiitis obliterans of the testicular vessels heretofore reported in the literature, this test has not been employed.

The treatment of choice is orchidectomy. The disease is usually progressive and causes such annoying pain and discomfort to the patient that extirpation of the testicle is justified. JOHN A. LOEF, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Loi, L.: Acute Osteomyelitis Followed up by Roentgen Examination During the Course of Conservative Biological Treatment (L'osteomielite acuta seguita radiologicamente durante la cura conservativo-biologica). *Clin. chir.*, 1940, 16: 543.

The author describes and illustrates with roentgenograms 12 cases of acute osteomyelitis which he treated without operation. In only 1 case was any drug used. In the others the treatment consisted of rest in bed and the application of hot, moist compresses to the affected bones. The results of this treatment were followed up by repeated roentgen examinations from the early stage of the disease until the patients were discharged cured.

In general the roentgen images seen in following up these cases showed, first, necrosis of the bone, then absorption of the necrosed bone, and, finally, bone regeneration. Even in the cases with extensive necrosis, when the patients came under treatment there was normal repair and finally complete or almost complete restoration to normal. In all of these cases the process remained limited to the area affected at the beginning of treatment. The most striking feature of this treatment was that even when large tracts of bone were necrotic they were absorbed without the formation of large sequestra. In a few of the cases small cortical sequestra were formed but they were discharged spontaneously and no large central sequestra were formed in any case. Nor was there any diffuse or circumscribed sclerosis of bone which in the usual treatment of acute osteomyelitis interferes so seriously with healing.

Necrosis was not prevented in any of the cases, all of which were caused by virulent staphylococci. The great value of the treatment lies in the prevention of the formation of large sequestra, which results in the transformation of an acute into a chronic type of osteomyelitis.

The results of this conservative treatment have been so good that at the Surgical Clinic of Pisa, where at first it was used only in the acute stage followed by operation, it is now used throughout the course of the disease until complete cure.

AUDREY G. MORGAN, M.D.

Dick, G. F., Hunt, L. W., and Ferry, J. L.: Calcification of the Supraspinatus Tendon; A New Treatment. *J. Am. M. Ass.*, 1941, 116: 1202.

The symptoms of calcification of the supraspinatus tendon are pain in the region of the apex of the shoulder joint, muscular spasm, or varying degrees of limitation of abduction and rotation. Roentgen examination reveals shadows of varying density.

The part which trauma and foci of infection play in the etiology is discussed and a new treatment is proposed. This consists of (1) large doses of ammonium chloride, (2) rest of the diseased part, (3) physical therapy, and (4) elimination of foci of infection. The rest was obtained by means of a sling by day and pillows by night. Physical therapy in the main consisted of the use of the inductotherm. In one of the authors' patients there was an increase of pain after removal of an abscessed tooth. In other patients apparently complete recovery occurred in spite of definite foci which remained untreated. Five cases are reported, in all of which clinical recovery occurred as well as disappearance of the deposits seen with the roentgen rays. All of the patients were given 4 gm. of ammonium chloride daily and 1 was placed on a ketogenic diet. The duration of treatment with the ammonium chloride is not definitely stated. The authors state that the beneficial effect of ammonium chloride is due to the lowering of the hydrogen-ion concentration of the blood. The blood carbon-dioxide values in one patient seemed to indicate a mild acidosis.

HAWTHORNE C. WALLACE, M.D.

Finck, J. F. von: Tuberculosis of the Spine and Its Cure (Die Wirbeltuberkulose und ihre Heilung). Stuttgart: Ferdinand Enke, 1940.

The author presents the results obtained in the German Institute for Spinal Tuberculosis in Klotzsche, which was founded by him in 1927. He is convinced that all patients suffering with spondylar disease should be gathered together in one hospital where the nursing and the entire "habitus of the institution" is designed for the treatment of this one disease. It is because of this and as a result of the logically founded, careful, and methodical procedure that "one of the most severe, and hitherto regarded as incurable, diseases of mankind" can be cured completely. The cure, however, rests upon the recognition of the significance of absolute muscular rest as one of the strongest biological healing factors, a factor which the author employs in the treatment of spondylitis by means of the most thorough and widespread splinting of the body from the top of the head to the toes. The effectiveness of this immobilization rests not only upon mechanical principles such as the prevention of the transmission of the movements of respiration to the vertebral column, but also upon the fact that those muscles of which the action is not of importance for the maintenance of life are prevented from consuming the energy necessary for the fight against the exciting causes of tuberculosis, and thus these energies are placed at the complete disposal of the body. However, it is of great importance always to carry through the treatment to complete healing of the tuberculous focus. In this respect one must free himself from the erroneous idea of immunization and not yield repeatedly to the temptation of employing some newly discovered

specific cure for tuberculosis, because tuberculosis is not a generalized disease similar to an acute infection, but rather a disease of the tissue and the tubercle bacillus is a tissue parasite. The goal must necessarily be to maintain all curable patients in healing institutes up to the time of a definite cure and to institutionalize all those who are incurable.

Within the realm of a short review it is impossible to go into greater detail concerning the discussions of pathogenesis, pathology, symptomatology, and diagnosis. The author has based these excellent and clear discussions upon decades of research and experience and they are elucidated throughout by exceptionally excellent and characteristic illustrations. It is of value, however, to study these chapters in detail because they are capable of elucidating many still moot questions, and they contain thoughts and many conclusions which, although deviating from the generally accepted conceptions, are, nevertheless, almost always well founded and based on critical thought. Thus, for example, the primary disease of the intervertebral disc as the etiological focus of the tuberculosis of the vertebral bodies is discussed, as well as the mechanical development of gibbus and buckling, and the formation of suggillation abscess and its dependency upon the tissues surrounding the spinal column, a fact which may, for example, result in the prevention of thoracic abscesses from wandering further because they are stopped by the connective tissue which has been stimulated to form granulations, whereas cervical and lumbar abscesses may push directly into the muscle interstices. The size of the abscess *per se*, therefore, has no prognostic significance, rather, only the length of the traversed distance and the resulting involvement of other organs. The widely accepted opinion that pus which has become thickened and gruel-like in consistency, as the result of the admixture of caseous masses, is the more favorable one, is false. Tuberculous pus always becomes thinner in consistency and more clear before it completely disappears.

According to the experience of the author, spondylitic paralyses are primarily caused by pressure resulting from callus masses and peridural connective tissue proliferations which develop during the stage of regeneration. Their ultimate cause is not pressure injury but circulatory disturbance. Cord tissue which is only compressed but not involved by myelitis remains capable of restitution even after the compression has existed for a long period. Very important also are the discussions concerning clinically latent tuberculosis of the spine. In the lumbosacral region, in the absence of gibbus and in cases of isolated involvement of the fifth lumbar vertebra, a lordosis may lead to a mistaken diagnosis, just as in malum suboccipitale; these conditions have in common the gliding upon anatomically preformed gliding surfaces, and the author proposes the term "Malum vertebrale supra-sacrale." Many a case of spondylolisthesis apparently belongs to this group since the total atrophy of the intervertebral disc, which is observed in these cases, possibly rests only upon local destructive inflammatory processes. The author also gives a learned presentation of the symptomatology and diagnosis in which he particularly warns of neglect of the general systemic examination. The most exact directions and advice for testing of the motility and the elicitation of pressure and impact pain are given, and with respect to paralysis, directions are given for careful observation of mild paretic or spastic phenomena and reflex anomalies especially as far as their differential diagnostic importance is concerned. All is convincingly presented on the basis of subtle observation and examining technique.

The method of therapy in all of its phases is based upon the unconditional physiological rest of the entire body. An important part of this therapeutic method is the open air treatment, which, as is also customary in the treatment of tuberculosis of the bones elsewhere in the body, is carried out on rest porches upon which the patients are rolled out by means of specially constructed portable cots, and at night the patients are kept in sleeping chambers in which the temperature is at least 12 degrees R. An important part of the therapy is the attention to the psychological factor: for the three to five-year-old children supervised play by trained kindergarten teachers, for the larger children basket weaving and instructions by teachers employed by the state; and for the women handiwork is advised. The nutrition should consist of a mixed protein and high caloric diet. Fat is only a burden and the idea of a "fattening cure" should be abandoned.

Very original proposals for the prophylaxis of secondary relapses are made: every patient in the institute receives daily on the fasting stomach an "iodine cocktail" (metallic iodine 1, potassium iodide 10, aqua distillata 100). Children receive 3 to 5, and adults 8 drops of this mixture in milk. This iodine prophylaxis is thought to have been the cause of the fact that the institution, since its existence, has not seen a single cold and only 8 cases of sore throat. In cases of bronchitis, intramuscular injections of ether are given; in gastric disturbances (also in summer diarrheas) xeroform is given per os (1 gm. daily), and in smaller children this dose is divided in 2 or 3 parts. The resin mixture "Kleol," introduced and used by Finck since 1900, which is supposed to have a definitely germicidal action upon the skin bacteria and produce an "absolute sterility," is useful in preventing secondary infection of fistulas. In puncturing abscesses, one should not endeavor to aspirate the entire content but should remove only 30 to 50 c.cm. in order to avoid the excessive pressure which may lead to perforation.

The treatment is carried out with the well known plaster cast and the cotton cross used as a wedge in the lumbar region. The latter should be increased in height only gradually, and with the greatest care and caution. It is not extension but rather compression which is the effective factor, since the aim is not to increase the length of the spinal column but rather to shorten it. Above everything else, care

must be taken to maintain the unconditional permanence of this pressure. Thus, for example, it must also be maintained while arranging the patient for solar radiation. The latter, according to the author's opinion is not at all the panacea of tuberculosis, and should be carried out with restraint, not more than one hour daily. The decision as to the time for ending the horizontal position in the plaster cast and the application of a supporting corset is determined first and foremost by the general condition of the patient. In those cases in which undernourishment still dominates the clinical picture, getting out of bed cannot be permitted, because when tubercle bacilli are still active there can be no progress in healing. Furthermore, when there is evidence of a re-establishment of growth, which is always a sign of healing, the patient may be permitted out of bed.

The supporting corset must reach up to the head and have sharp edges at its upper end so that it will prevent the patient from supporting his head upon the surface. In this way it will cause the back muscles to remain under constant tension. Caudally, the corset must be brought down far enough so that sitting, which causes an increase in the kyphosis, is made impossible. The Hessing corset is, therefore, not suitable for this purpose.

As long as wedge-shaped vertebræ are still visible in the roentgenogram, the tendency toward buckling is still great, and the corset will have to be worn even if it should take years. It is only when this roentgen finding disappears that one may count upon a change of the vertebra to a rectangular form, and it is only then that one may gradually do away with the corset. Only in those cases in which this reconstructive process is absent is spinal fusion indicated. The average duration of therapy was about one and one-half years, the shortest was eight months. Even the most severe forms of spondylitis resulted in cure. (Sievers). Harry A. Salzmann, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Henschen, C.: The Treatment of Paget's Osteitis Deformans (Die Behandlung der Ostitis deformans Paget). *Schweiz. med. Wchnschr.*, 1940, 2: 945.

The various theories regarding the origin of osteitis deformans are briefly discussed. The majority of the surgical clinicians consider Paget's disease a chronic osteitis, an inflammation with diminished inflammatory symptoms according to Roessle's interpretation. There are several clinical manifestations in Paget's disease which prove that, figuratively speaking, a concealed inflammation smolders within the bone. They are: local hyperthermia within the Paget area; increase of oscillometric readings occurring either by degrees or spontaneously; local perspiration; osteal-gia; the roentgenogram shows a tendency toward the formation of detached, sterile sequestra; a tendency to sclerosis in the cured areas; malacia and lack of bone substance from over-activity in the surrounding area of the affected bone which is undergoing a precipitated transformation with resulting sensitivity when used.

The author discusses in detail all possible cases which may present themselves for treatment. In cases of the cerebral type of this disease the following symptoms are apparent: (a) general cerebral pressure; (b) circumscribed manifestations of either cerebral stimulation or deficiency; (c) disturbances of the cerebellum; (d) cerebrobasal manifestations; (e) disorders of the hypothalamus; (f) narrowing of the ocular canal; (g) trigeminal neuralgia; and (h) oral disorders and disturbance of the equilibrium. Clinical types are classified, as follows: the craniofacial, the clavicular, the thoracic, and the pelvic. The latter, in particular, is linked with modifications of the hip-joint and its respective disorders—neuralgias, and rectal and urethral compression. Furthermore, there is a spinal type which may result in pressure upon the spinal medulla. The common leg type involves either the entire leg or only the upper leg or tibia. In these cases static bending and, particularly, fractures, as well as a tendency toward the development of sarcoma must be emphasized.

General treatment is directed toward: (1) influencing the bone disease through adequate diet (calcium and vitamins); Vitamin D is not recommended on account of the danger of calcium metastasis; (2) insulin treatment with simultaneous regulation of the carbohydrate intake; (3) venisection transfusions; (4) autovaccination; (5) heliotherapy; (6) parathormon therapy; (7) the administration of preparations from parathyroid cortex; (8) experimental antiluetic treatment; (9) the treatment of arteriosclerosis associated with Paget's disease; and (10) the treatment with sodium fluoride, which is said to influence the phosphatase. Some authors urge roentgen therapy. It should be emphasized, however, that Paget's sarcomas have almost always proved to be refractory to irradiation.

Special attention is given to the investigation of surgical measures. First of all, an operation for the elimination of pressure in the region of the cerebral nerves is considered. Trigeminal neuralgia can be treated successfully by means of electrocoagulation. The acoustic and optic nerves can be relieved of pressure by the use of the "canal operation" according to Schloffer. Operative intervention within cerebral regions impaired by pressure require unilateral or bilateral trephining under certain circumstances. Complete trephining of the calvarium by means of a circular craniotomy may come into consideration. In case of pressure on the spinal cord, laminectomy may be helpful. However, the author demands, in addition to relief of the pressure upon the spinal cord, the insertion of an inner support (acanthasynostosis or Albee's operation). Manipulative treatment is used for Paget's fractures. In cases of malformation, osteotomy is resorted to for further improvement. Excessive longitudinal growth is treated with osteotomy for the purpose of shortening the bone. A new method suggested by Henschen is a partial

resection of the affected bone. He has frequently chiseled off the medial anterior layer of the tibia from one metaphysis to the other; he has made a wide trephining space at the upper femoral end and has removed the exterior of the cranium. He believes that this operation makes possible a self-cleaning process of the diseased bone in case of post-operative inflammation, and that the excessive pressure in the medullar cavity may be decreased.

Regarding Paget's sarcoma, Henschen is of the opinion that it is of multicentric origin. He believes that by the use of filtered tissue extracts from the principal growth center of the affected bone, a bone sarcoma might be induced in an animal with a tendency toward sarcoma. Operation on the parathyroids is ineffective both in the fully developed and in the preliminary stage of Paget's disease.

(HELLNER). HILDA H. WHEELER.

Finochietto, R., and Uriburu, J. V.: Tuberculosis of the Elbow. Operative Treatment and Technique of Economical Resection with Arthrodesis (Codo: Tuberculosis. Tratamiento operatorio y técnica de la resección económica con artrodesis). *Dia. méd.*, 1941, 13: 202.

Tuberculous osteo-arthritis of the elbow in children generally heals with immobilization; occasionally a surgical procedure is necessary. In the adult the problem changes; some authors employ non-operative procedures, but the majority frankly recommend operation.

González, Aguilar, and others have established the selection of treatment of osteoarticular tuberculosis according to the allergic period of the infection, according to the ideas of Ranke. The child generally shows an articular lesion in the second period, but occasionally one can find lesions which develop during the third period. In adults one commonly finds lesions during the third period, or the stage of relative immunity. The disease develops into a chronic process without any tendency toward healing.

The osteo-articular lesions of the second period must not be operated upon, but those which develop during the third period should receive surgical treatment. These modern conceptions justify in a certain way the classical formula: "Conservative treatment in children; resection in adults." An operation performed during the second period may end in disaster: dissemination and death. The clinical findings help to distinguish the second from the third period because in the second period there are strong exudative perifocal reactions, with general involvement of a violent character: it is an evolutionary state. On the other hand, in the third period the general symptoms disappear and local lesions dominate.

Surgeons do not agree on the treatment of tuberculosis of the elbow in adults; some prefer clinical treatment, some surgical treatment, and some that treatment which to them best suits the individual case. To-day, the treatment by exclusive orthopedic procedure is very seldom followed.

Fig. 1.

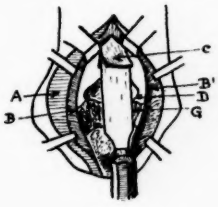

Fig. 2.

Its use is indicated only in very benign cases which are not suitable for the operation.

The authors believe that many of the so-called complete healings by simple immobilization hide a tuberculous granuloma which has been choked by the fibrous reaction, but is always ready to become active on the slightest trauma or movement. The pseudo-ankylosis of such an elbow still shows imperceptible movements because tuberculous joints never undergo spontaneous bone ankylosis. This is true especially of the elbow, which is the worst joint for successful arthrodesis. For this reason the authors insist that every tuberculous osteo-arthritis in adults who are in the proper allergic period must be operated upon. The surgeon can perform a typi-

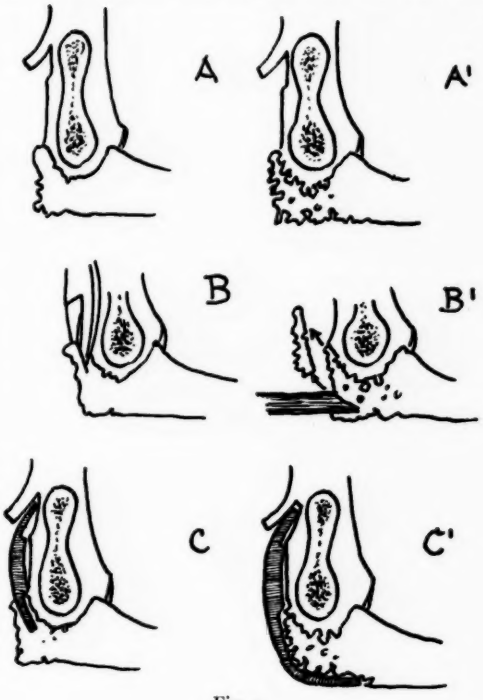

Fig. 3.

Fig. 4. A, graft; B, bone peg of radius and humerus; C, chips in fossa olecranon; D, chips in cubio-humeral articulation.

cal resection which preserves the mobility of the joint, or an operation which produces ankylosis. The authors prefer the last, especially the economical resection with arthrodesis. The classical resection is not recommended; one is never sure that all of the diseased parts have been removed and there is always the danger of leaving some of them with a movable joint. It is a questionable procedure which does not exclude the possibility of shortening, and the mobility of the joint is far from perfect.

Arthrodesis produces healing through suppression of the articular function. Extra-articular arthrodesis is an excellent procedure in joints of difficult interarticular approach. The elbow can easily be opened and economically resected. Therefore, the authors perform external arthrodesis with resection.

Chutro, some years ago, said that the surgical treatment of osteo-articular tuberculosis is not an attempt to eliminate all of the diseased tissues of the joints, but to obtain osseous ankylosis, to bring about the slow disappearance of the lymphoid tissue, and as a result remove the cicatrization of the neighboring foci.

Total suppression of the focus is almost impossible. Extirpation of the synovial membrane is accomplished when possible; the cartilage is taken out, but the ligaments are preserved. This favors a perfect reciprocal contact of the surfaces of the joint immediately after the operation.

For many years Ricardo Finochietto performed the operation with the following technique: economical resection of the elbow joint with synovectomy, and intra-articular and extra-articular arthrodesis. He prefers a rib graft, which can be taken easily and adapted readily to the proper shape, and which provides a good number of chips.

The operation begins by taking the graft from the fifth or sixth rib. It should always be larger than necessary so as to furnish the chips.

Local anesthesia of the elbow is secured with 100 c.cm. of ½ per cent novocaine. The injections are made according to Figs. 1, 2, and 3. The incision, (Fig. 1) begins 6 cm. above and ends 6 cm. below the tip of the olecranon.

The cutaneous flap is dissected just enough to expose the medial part of the olecranon. With proper care for the ulnar nerve, the deep tissues are incised. With a periosteal elevator or dissecting knife the olecranon is freed and the joint is opened. Then follows the extirpation of the synovial membrane and of the cartilage, with small curettes of the Hibbs type (Fig. 1). To receive the proximal end of the graft the triceps must be dissected upward just above the fossa olecrani. An osteoperiosteal flap is lifted with a chisel so that its hinge lies 2 cm. above the limit of the fossa (Fig. 2). The bed of the olecranon can be made in two ways: if the lesions are not very important, one can chisel a groove which receives the graft; with extensive lesions the whole posterior surface of the olecranon is freshened and the graft is held in place by the fibroperiosteal suture (Fig. 3).

The proximal part of the graft is introduced under the humeral bone flap; then some bone chips are added to bridge the humerus and the olecranon and are placed in the fossa olecrani. The radiohumeral joint must be immobilized with some chips or a bone nail (Fig. 4). The operation ends with the placement of the inferior end of the graft and the proper suture of the deep tissues and the skin. The joint is kept immobilized for one year. HECTOR MARINO, M.D.

FRACTURES AND DISLOCATIONS

Thompson, G. C. V.: Paralysis of the Serratus Anterior Muscle Complicating Dislocation of the Shoulder. *Med. J. Australia*, 1941, 1: 231.

The author stresses the need for a careful routine examination of all patients with dislocation of the shoulder to determine the functional integrity of the brachial plexus. While the axillary nerve is liable to injury because of its exposed course, one may be able to demonstrate minor grades of paralysis in other muscles about the shoulder. The author reports isolated paralysis of the serratus anterior muscle from contusion of the long thoracic nerve of Bell. This complication is most likely to occur if the head of the humerus passes into the subclavicular position by sliding under the coracohumeral muscle. With paralysis of the serratus anterior muscle the vertebral border and lower angle of the scapula become more prominent, the spine becomes more horizontal, and the lower angle comes nearer the midline. This winging appearance is usually quite obvious but disappears on flexion of the forearm. The patient is unable to raise the arm higher than the horizontal plane in front of the body and weakness of the shoulder movements is particularly obvious when the arm attempts to push forward. Isolated paralysis of the serratus anterior muscle is very rare and a careful examination of the triceps, biceps, and other shoulder muscles should be made before it is assumed that the paralysis is an isolated one.

In the treatment it is most important to keep the serratus muscle relaxed for from three to six months and then toned up by massage and electrical stimulation. The author recommends a cloverleaf sling of Foucar, a threefold loop of webbing encircling the wrist of the affected side and the patient's neck and passing under the opposite axilla, which uses the center of the opposite clavicle as a fulcrum around which the scapula is derotated. When, however, the paralysis of this muscle is permanent, muscle-transplant operations in which the lower part of the pectoralis major muscle is detached from the humerus and inserted into the lower angle of the scapula are advised. However, as the nerve lesion in such a case as the author reports is a contusion only, regeneration should be complete and operative procedures should not be found necessary.

PAUL C. COLONNA, M.D.

Bertola, V. J., and Ordóñez Ferreyra, H.: Treatment of Fracture of the Patella (Tratamiento de la fractura de la rótula). *Bol. y trab. soc. de cirug. de Cordoba*, 1940, 1: 35.

The authors give an anatomical and embryological discussion of the patella, stating that the most important thing in maintaining the function of the leg after fracture of this bone is not the healing of the fragments of the patella but the maintenance of the normal position and function of the extensor muscles. This is illustrated by roentgenograms, photographs, and a diagrammatic sketch in a case of fracture in a young man who fell in a football game with the knee in semiflexion. He came for treatment fifteen days after the accident.

The authors criticize the method of cerclage, which is in common use in the treatment of such fractures. In addition to causing failure of union on account of the formation of fibrous callus, it reduces the degree of flexion, and produces a rarefying patellitis due to the action of the foreign body, a painful periarthritis, and a fixation of the patella to the femur, all of which cause great functional incapacity.

The method of treatment which the authors recommend is simple and can be carried out by any skillful surgeon. It includes careful and anatomically accurate repair of the extensor muscles and secondary suture of the patella. Absorbable suture material is used. No irritating body is left in contact with the joint. The leg is then put in a Boehler's plaster stocking with the bone protuberances carefully padded with cotton. The patient begins to walk the second week and the cast is kept on for seven weeks. This method is based on an understanding of the physiopathology of rupture of the extensor muscles of the leg. The functional treatment consists of active mobilization, massage of the quadriceps muscle, mobilization of the patella, and Bier's baking, which facilitates the task. Supplementary medication, such as vitamins and calcium, may be given to the patient.

AUDREY G. MORGAN, M.D.

Rossbach, A. F.: The Treatment of Fractures of the Lower Leg, with Special Attention to Boehler's Method (Die Behandlung der Unterschenkelbrueche unter besonderer Berueecksichtigung der Boehlerschen Methode). Frankfurt: Dissertation, 1939.

The author presents a historical review of the operative treatment of fractures, and emphasizes the newer developments, especially those of Fritz Koenig. He mentions the use of Lane and Lambotte plates, wires, Parham bands, bone sutures, nails, screws, and, lastly, autoplastic transplantation. In contrast to this he describes the influence of various men such as Steinmann, Klapp, and Kirschner, and he emphasizes the fine work of Boehler, who combines functional treatment with the use of traction and has given especial prominence to the unpadded cast. The Florken clinic has used the method of Boehler since 1930. Fractures in the lower third of the lower limb without displacement or with only slight displacement are treated immediately with an unpadded cast. Fractures with much displacement and swelling are manually reduced as much as possible and then immobilized on a Cramer splint for from six to eight days. Then under spinal anesthesia, skeletal traction with a wire is used. With the leg lying in a Boehler splint and the knee bent at a right angle a pull of 20 kgm. is sufficient to correct the worst displacement and distortion. As soon as the displacement is corrected the weight is reduced to from 10 to 15 kgm. An unpadded posterior splint is then laid from the knee to the tips of the toes. Gauze bandage is wrapped around the limb from the knee to the ankle joint. At the heel the splint must be cut on both sides, the corners laid over one another, polished, and smoothed. The gauze bandage is then continued further to the toes and three circular rolls of plaster are laid over all. The leg lies on the splint in semiflexion. With a pull of about 3 kgm. the foot hangs from the crossbar of the splint. This dressing is used for about three or four weeks or with a more serious comminuted break for about five or six weeks. Then a new plaster is applied, still under extension; it reaches to the middle of the thigh. After union has begun the extension is removed and a walking iron incorporated in the plaster. When this fracture is united the bandage is changed for one below the knee only. About twelve weeks after the reduction the leg is wrapped in an Unna's paste bandage. This should be worn for half a year, being renewed every four weeks. Young people can resume heavy work after three or four months, older people after from four to six months. The Dohler transfixion method, which requires 3 nails has been used only a few times by the author.

With compound fractures the clinic proceeds differently. After operative care of the wound the limb is laid on a splint with a pull of 3 kgm. on a wire introduced through the heel. The pull should be increased to from 5 to 10 kgm. The traction dressing remains from two to six months. Fractures of the shaft of the fibula are treated for four or five

weeks with an Unna's paste dressing and a coating of plaster-of-Paris. The patient can then move about.

The author then compares the statistics of 25 authors for the earlier years from 1894 to 1936. These show great differences. First, in respect to the hospital stay, Wettstein reports seventy-five days as the average for complicated and uncomplicated fractures. Weiner and Wettscher give eighty days for closed, and one hundred and thirty-eight days for open breaks. Second, the duration of full disability ranged from one hundred to three hundred and forty-nine days for closed fractures. Third, the percentage of disability for closed fractures ranged with different authors from 0, 13, 25, and 43.5 per cent to even 93.7 per cent, while Lundgreen who gave statistics on 389 cases from the year 1936 reported the disability as only 16.2 per cent. For compound fractures the percentages ranged from 42.5 and 44.4 per cent to 67.4 per cent.

The author then reports on fractures of the lower leg from the Florken clinic observed during the period from 1921 to 1937. These cases amounted to 92 per cent of the total, but only 25 patients answered his questionnaire. From 1921 to 1929 the padded cast was used, sometimes with nail and wire extension; and on definite indications 16.4 per cent of the patients were operated upon. Three of them died, 2 from traumatic brain hemorrhage, and 1 from bronchopneumonia after amputation. Two pseudarthroses were healed by means of Beck's drilling. Fifty-two cases, that is, 50 per cent, were treated by means of Kirschner's wire traction. Operative treatment was never used immediately.

The duration of confinement to bed was reduced with the Boehler treatment by 36.6 per cent. The time of healing and the absence from work were both reduced by the decreased confinement to bed. Stay in the clinic dropped from sixty-two and seven-tenths days to forty-seven and three-tenths days—a reduction of about 24.5 per cent. Duration of the disability could not be compared because of the length of time elapsing between the two groups of cases compared, but it must be noted that since the adoption of the Boehler treatment only 1 patient drew compensation amounting to over 20 per cent—namely, 33⅓ per cent. Furthermore, if the results in the two groups are classified as very good, good, indifferent, and poor, the advantage is very much with the Boehler treatment. In addition, the results with the Boehler treatment became better year by year as it was used.

(Franz). Hawthorne C. Wallace, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Ghitzescu, C. I., and Robacki, J.: The Nutrition of the Arterial Wall. A Normal and Pathological Study of the Histophysiology in Relation to Surgical Treatment and to the Pathogenesis of Arterial Diseases (Die Ernaehrung der Arterienwaende. Normales und pathologisches Studium der Histophysiologie im Verhaeltnis zur chirurgischen Behandlung und zur Pathogenese der Arterienkrankheiten). *Arch. f. klin. Chir.*, 1940, 199: 394.

The authors attempt to study the structure of the arteries from the standpoint of the functional demands upon them. They concern themselves, therefore, particularly with the manner in which the arterial wall receives its nutrition. The various vascular layers are permeated with two nutritional streams of unequal significance. The first flows through the vasa vasorum and supplies the adventitia and outer muscle layer. The rest of the vessel wall is nourished from the vascular lumen, by diffusion.

Under pathological conditions, the degree and extent of vascular damage is determined by the manner in which the artery wall is nourished. The adventitia also possesses lymph capillaries, whereas the endartery and muscular layer discharge their excretory products into the interstitial or lacunar lymph. Obstructions to the lymph flow explain many peculiarities of the pathological changes in a vessel wall. Lymph stasis or obstruction of the return circulation of the nourishing plasma plays a significant role in the formation of edema of the artery wall. On its basis, the various degenerations of the arteries such as fatty infiltration arise.

(SUNDER-PLASSMANN). LEO M. ZIMMERMAN, M.D.

BLOOD; TRANSFUSION

Lenggenhager, K.: A Solution of the Problem of Blood Restoration (Eine praktische Loesung des Blutersatzes). *Zentralbl. f. Chir.*, 1940, p. 1961.

The ideal substitute for blood is fresh homologous blood. The effect of all other substitutes such as saline, glucose, or Ringer's solution, is very transitory. In from fifteen minutes to one hour, 50 per cent, and after two hours, from 80 to 90 per cent of the solution has disappeared from the circulation regardless of the amount infused. Agents introduced to prolong the effect by increasing the colloidosmotic pressure, such as an 8 per cent solution of vegetable gum arabic, act as foreign bodies and easily produce shock. According to studies made by the writer, the erythrocytes show very marked agglutination. The disadvantages of stored whole blood are:

1. Instability—the blood keeps only for two or three weeks when stored by the citrate-glucose method. If stored according to the thiosulfate method of Corelli, it will keep for six weeks, but experiences with large transfusions are lacking.
2. It must be preserved at low temperatures, from 2 to 4 degrees.
3. Tests with specimens preserved for more than fourteen days show frequent fever and chills.
4. Sterility tests are required.
5. Transportation requires care.

Studies made by Schoercher have shown that the presence of erythrocytes as oxygen carriers is unnecessary, and that exsanguination results from inadequate filling of the blood vessels. Acute hemorrhage with loss of 30 per cent of the blood volume usually caused death of the animal and loss of 50 per cent of the blood volume always caused death of the animal. If the circulatory tract is filled with serum or plasma, the animals tolerate a blood loss which leaves from only 10 to 15 per cent hemoglobin, and if filled with teltofusin only 35 per cent. That the erythrocytes do not cause the chief disturbance resulting from loss of blood is evident also from the fact that in human subjects a hemoglobin level of less than 60 per cent can hardly be tolerated, whereas patients with chronic anemia may survive with hemoglobin levels as low as 12 per cent.

As a proof of the value of sudden filling alone, the author reports a case of cut throat with injury of one carotid artery. After a few minutes, the bloodless, unconscious patient, whose wound was no longer bleeding, was given an intravenous infusion of 1.2 liters of tutofusin. Following the injection of this amount, a jet of blood as thick as a finger issued from the external carotid ligature. The patient regained consciousness and subsequently received a blood transfusion.

Serum, plasma, and ascites fluid are protein solutions which undergo autolytic changes on preservation. For this reason dried serum has been recommended. Riguchi had good results with dried serum, the erythrocytes being included and centrifuged off following dilution with glucose, Ringer's, or tutofusin solution. Schoercher utilized a dried serum (only in animal experiments) produced by alcohol precipitation of serum protein. The disadvantage of both methods lies in the fact that the powder is not completely soluble. Lenggenhager has now prepared a dried human serum which is easily soluble when ½ to 1 volume of water is added to the original volume of serum. He obtained this serum by adding 7.7 gm. of glucose solution to every 100 c.cm. of serum. This dissolved glucose-dried serum withstands boiling but is positive to most other protein tests. After animal experimentation, he tried gradually increasing intravenous infusions up to 300 and 650 c.cm. in 33 human subjects. There is no necessity for consideration of the blood groups as the agglutinins and hemolysins are destroyed by the boiling. Nor is a Wassermann test necessary. The author observed no subjective disturbances, and of prime importance is the fact that this serum was re-

tained for a long period in the circulation, as demonstrated by his coworker Wapf. Usually it takes three days for the fluid volume to be regained after a severe blood loss, because the influx of tissue fluids into the circulation begins to exert an effect only from four to six hours after the hemorrhage. As the serum remains in the circulation for from eight to eleven hours, this period is bridged over, during which the body is as yet incapable of making full compensation. As all other blood substitutes disappear from the circulation after two hours, their effect can be only transitory. It is also of importance to note that this dissolved dried serum produces no anaphylaxis. After animal experiments, the author made careful experiments in patients with inoperable cancer. He never observed any symptom of hypersensibility even when a second infusion of from 400 to 600 c. cm. was made three or four weeks after the first. He then made experiments with the dried sera of oxen, hogs, and horses. Also these can be rendered wholly fluid by the addition of 10 gm. of glucose to 100 c. cm. of serum, and when diluted with double this volume (as compared with the original serum volume) the fluid can be boiled without precipitation. The author also tried this dried serum in inoperable cancer patients, and infused from 300 to 650 c.cm. intravenously without signs of intolerance. Repeated injections failed to produce serum exanthema and anaphylactic symptoms. In only 4 patients who received an animal serum mixture, in which errors of technique were discovered (too heavy a film, too slow drying), chills and fever of 39 degrees developed six hours after the injection but had disappeared by the next day. This was the result of bacterial toxins, as the bacteria had been destroyed by boiling.

An interesting observation was made in one of these cases. The patient was suffering from multiple tuberculous abscesses of the soft tissues of the bovine type. These had been punctured every third day for three weeks. Following the injection of the animal serum, the abscesses did not refill.

The advantages of such dried animal serum include: (1) an inexhaustible supply, (2) donors can be dispensed with, (3) easy transportation, and (4) sterility. It can furthermore be utilized as a blood substitute in all diseases associated with hypofunction of the circulation, as a substitute for proteins in cases of extensive protein loss (empyema with daily excretion of from 200 to 500 c.cm. of pus), and as a nutrient following operations made on the intestinal tract.

After testing the method on 55 patients in quantities of from 300 to 650 c.cm., the writer turned it over to the Ciba Company of Baset who now supply a dried ox serum. If excessive quantities have been dissolved, the sterile solution can be preserved for months without change, and should not be boiled before being used again as this would cause a caramelization process. Such a serum would produce shock (sensation of heat in the head, tremors, sacral drawing pain, dyspnea, and frequently sudden urticaria) even in quantities of 50 c.cm.

(Franz). Edith Schanche Moore.

SURGICAL TECHNIQUE

WAR SURGERY

Mitchiner, P. H.: General Principles of Treatment of Air-Raid Casualties. *Brit. M. J.*, 1941, 1: 309.

Mitchiner states that the number of casualties from air raids has been smaller than anticipated. Though the proportion of killed to wounded is high (1 to 2), the vast majority of those wounded suffer from very slight multiple wounds requiring no surgical intervention, while of the seriously injured many are too ill to be helped by surgical skill.

First-aid squads are cautioned against unnecessarily elaborate dressings and splints, and too long exposure of patients to cold and collapse by keeping them undressed. They should remember that arrest of hemorrhage with pad and bandage, and splintage of fractures are all that it is desirable to achieve, in order that the victim may be conveyed quickly to the warmth and cover of a hospital. Squads should be trained to work in the dark, or by candle or electric torch; and they should be able to carry out their work in a gas mask.

All cases should go to a hospital receiving room and there be seen and carefully sorted by an experienced medical practitioner or surgeon; and for this to be done efficiently some system of colored tabs is essential, so as to insure precedence for cases of hemorrhage, open chest wounds, and burns. The value of team work in insuring the maximum of efficiency in the minimum of time, so as to avoid a block during the rush of casualties, is emphasized. Wound shock needs treatment early, and the severe cases may need serum, plasma, or blood transfusion, in addition to the usual treatment. Rest after treatment and before evacuation is essential in shock cases.

Bomb wounds, if bad, lead to fatal results either directly or from their severity; the majority take the form of peppering with small or medium-sized fragments. Such wounds must be carefully examined to ascertain that no body cavity has been penetrated, and if any doubt exists the wound must be excised and explored; otherwise the wound must be cleansed thoroughly and dressed. No redressing should be carried out for at least ten to fourteen days, when, in most cases, healing will be found to have taken place. Mitchiner advises giving sulfanilamide as a prophylactic against sepsis for the first four or five days. Glass wounds may penetrate deeply and do as much visceral damage as bomb fragments.

Fractures are mostly compound and must be dealt with by free excision of the wound and fixation of the limb either with plaster-of-Paris or traction. Results are good with immediate plaster-of-Paris dressing if the patient can be kept under observation for some days where the operation has been performed. Danger lies in infection and edema under the plaster, which cause gangrene of the limb. As a general rule, for first aid, all fractures of the lower limb should be put in a Thomas splint, and those of the upper extremity should be treated by splinting and binding to the trunk for transportation. In the event of open pneumothorax, a large pad and tight bandage must be applied at once, and the patient must be removed to the hospital immediately where very early operation is undertaken to cleanse the thoracic cavity and close the chest wall; such steps should precede any attempts at resuscitation. Hemothorax is best treated conservatively unless there is cyanosis, restlessness, and respiratory distress, when aspirations are indicated. Should subsequent infection ensue, operative intervention will be carried out. Perineal and buttock wounds should be regarded with grave suspicion and the abdominal cavity opened if any doubt is entertained that it may be perforated.

Burns may be so severe as to be fatal. With the wide choice of methods of dressing burns available, tanning gives the best results and is most generally applicable. Attending shock and hemoconcentration require early plasma or blood transfusion. The fluid must be transfused slowly to avoid pulmonary edema, for which reason intravenous saline solution is never given. Prompt tanning as a first-aid measure, with tea or tannafax compresses, and without previous cleaning, has resulted in less collapse and subsequently better fits the patient for surgery. At the hospital, after treatment of the shock, surgical cleansing to 6 in. beyond the skin edges, with opening of all blebs, is important. After the dressing, it is advisable to give sulfanilamide for four or five days because of the great tendency toward sepsis, and if the patient is vomiting it can be injected. Local sulfonamide packs for burns of the face and perineum are being advocated by some workers. Toxic effects, especially leucopenia, must be watched for with sulfonamide drugs. EDWIN J. PULASKI, M.D.

Zuckerman, S., Hadfield, G., O'Reilly, J. N., Alston, J. M., and Others: The Problem of Blast Injuries. *Proc. Roy. Soc. Med.*, Lond., 1941, 34: 171.

In this article the problem of blast injuries is discussed as follows:

ZUCKERMAN: Without causing external injury, the blast of high explosive may cause hemorrhagic lesions in various internal organs of experimental animals. The most conspicuous lesions are found in the lungs, where they vary according to the pressures to which the animals are subjected from small superficial hemorrhages to hemorrhages which affect the entire substance of the organs. Hemorrhagic lesions have also been observed in the pericardium and epicardium, the thymus, the liver, spleen, intestine, kidney, adrenal glands, bladder, and uterus. Hemorrhagic lesions have also been observed in the upper part of the trachea. Hemorrhages around spinal roots, especially in the thoracic region, are constant,

and pial and ventricular hemorrhages on and in the brain are occasional, at high pressures. Rupture of the ear drums has also been observed at high pressures.

Experiment has shown that the thoracic and abdominal lesions are due to the impact on the body wall of the pressure component of the blast wave, and not to any effect of the suction wave acting directly through the upper respiratory passages. The pulmonary lesions directly due to blast are thus comparable to some extent with hemorrhagic lesions which may occur as a result of severe falls or direct blows on the chest wall.

In air raids people are exposed not only to the direct effects of blast, but also to indirect effects such as violent displacement and the impact of falling or flying masonry, both of which may lead to pulmonary hemorrhages. Observation has shown that the direct effects will be experienced only very close to the explosion. Case histories are analyzed, and it is suggested that before diagnoses of internal injuries directly due to blast are made, attention should be paid to the possibility of internal injury due to indirect blast effects.

HADFIELD discussed the findings in 30 cases in which post-mortem examinations were done. In 17 cases multiple bilateral pulmonary hemorrhages were found, with little or no significant injury to the thoracic wall. With regard to the pulmonary hemorrhages, there was no essential difference between the human lesions in these cases and the lesions produced experimentally by Zuckerman. Hadfield found in the human cases that the hemorrhages were frequently deep in the lung and occasionally gave relatively little indication on the surface that they were so extensive below. Sections taken through the hemorrhagic areas showed that the blood lies almost exclusively in the alveoli and there was marked disproportion between the amount of blood in the alveoli and the relatively slight damage to the alveolar walls themselves. It was also noteworthy that the amount of hemorrhage into the lung in fatal cases varied within very wide limits. The discussant felt that capillary rupture did not account for all the capillary bleeding, but suggested that the clinical manifestations might be due to widespread and general capillary dilatation.

O'REILLY, continuing the discussion, observed clinically that several individuals with blast injury subsequently developed lobar pneumonia, with recovery after the administration of sulfapyridine. In 5 other cases, all the symptoms of acute abdominal catastrophe were manifest. In 2, abdominal section was performed but nothing was found save minute subserous hemorrhages.

In closing the discussion, ZUCKERMAN stated that without knowing in detail the circumstances under which casualties occurred, it was impossible to say that the hemorrhagic lesions that had been described in air-raid victims were due to blast alone. The question that had to be asked was: "How much are they due to the direct action of blast, and how much to the effects of being thrown against a hard object, or to the impact of masonry?" J. M. MORA, M.D.

Bywaters, E. G. L., Beall, D., Belsey, R. H. R., Miles, J. A. R., and Others: Crush Injuries with Impairment of Renal Function. *Brit. M. J.*, 1941, 1: 427, 432, 434, 449.

There have been 4 cases of crush injury of the limbs among air-raid casualties, which because of their general similarity in clinical course were thought to represent a specific and hitherto unreported syndrome. The picture presented is briefly as follows: The patient has been buried for several hours with pressure on a limb. On admission he looks in good condition except for swelling of the limb, some local anesthesia, and whealing. The hemoglobin, however, is raised, and a few hours later, despite vasoconstriction made manifest by pallor, coldness, and sweating, the blood pressure falls. This is restored to pre-shock level by (often multiple) transfusions of serum, plasma, or, occasionally, blood. Anxiety may now arise concerning the circulation in the injured limb, which may show diminution of arterial pulsation distally, accompanied by all the changes of incipient gangrene. Signs of renal damage soon appear and progress even though the crushed limb be amputated. The urinary output, initially small, perhaps because of the severity of the shock, diminishes further. The urine contains albumin and many dark brown or black granular casts. These later decrease in number. The patient is alternately drowsy and anxiously aware of the severity of his illness. Slight generalized edema, thirst, and incessant vomiting develop, and the blood pressure often remains slightly raised. The blood urea and potassium, raised at an early stage, become progressively higher, and death occurs comparatively suddenly, frequently within a week. Autopsy reveals necrosis of muscle, and degenerative changes and casts containing brown pigment in the renal tubules.

In the 4 cases described there were some changes common to all and other individual changes. The renal lesion consists structurally of severe degenerative changes in the proximal convoluted tubules, and more distally of brown pigmented casts of a color, in unstained preparation, similar to that of blood corpuscles. There are reactive changes around the casts and desquamated epithelium in the medulla (Figs. 1 and 2). On histological grounds, the matrix of the casts is thought to be composed not of red corpuscles but of desquamated epithelial cells. The pigment might therefore be accounted for either by excretion into the lumen from the blood stream of hemoglobin, myohemoglobin, or bile pigment, or possibly by the extrusion into the lumen of cells already pigmented.

Changes very similar to these are described following mismatched transfusion. The casts are not composed of red cells, but sometimes there are spherical bodies resembling them. Similar casts containing "hemoglobin" have been noted in eclampsia. The

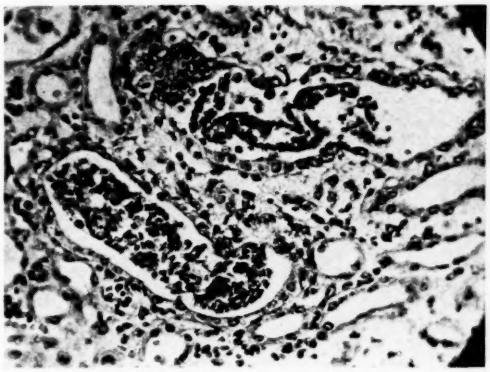

Fig. 1. Photomicrograph of renal collecting tubules from medulla, stained hematoxylin and eosin, showing, above, ribbon-like pigmented cast, and, below, similar cast invaded by polymorphs and surrounded by desquamated epithelial cells. × 160.

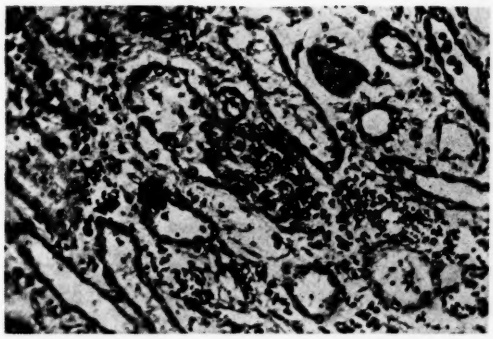

Fig. 2. Photomicrograph of renal tubule from boundary zone, stained hematoxylin and eosin, showing necrosis of wall and commencing reactive changes. × 132.

effect on function of blockage by casts is obscure. There was no significant concentration of urea hence no selective absorption of water, and in Case 1 there was failure to reabsorb chloride when the blood level was below 500 mgm. per 100 c.cm. Case II showed some degree of chloride reabsorption. There thus appears to be dysfunction of the convoluted tubules. Whether partial blockage or blockage of a few tubules can so raise the intrarenal pressure as to interfere with tubular function as well as with glomerular filtration is not known. It has been suggested that the degree of tubular blockage is not sufficient to account for the symptoms associated with "transfusion kidney." The hypertension noted in 2 cases, and also noted in the case reported by Mayon-White and Solandt may be allied to other types of primary "renal hypertension."

It is possible that minor degrees of this renal damage may occur, since at least 1 patient reported elsewhere with crushed limbs has been observed to recover completely with a raised blood urea and low urea clearance. In a similar case of muscle crush there was a definite tendency toward recovery of renal function; this was shown by the increasing resorption of both water and chloride. Certain cases of postoperative anuria may prove to fall into this category, but the majority of them appear to be associated mainly with decreased blood volume and blood pressure, since restoration of blood volume to normal improves the renal output.

Muscle necrosis is the one etiological factor common to these cases and to those observed elsewhere. It is known that when muscle is injured its permeability increases and intracellular ions such as potassium leave it rapidly. This may be related to the early increase of serum potassium which has been noted. An evaluation of the relative importance of muscle injury, renal insufficiency, and possibly adrenal cortical deficiency in the composition of this biochemical picture must await further data.

Oliguria in shocked patients may be due to dehydration, sweating, and the fall in blood pressure, since a pressure below 75 mm. Hg is insufficient to produce urine in the absence of circulating diuretic substance. The fall in blood pressure lasted for one and one and a half hours only in Cases I and II. Such oliguria facilitates the precipitation of relatively insoluble material in the tubules both in man (e.g., sulfapyridine calculi) and experimentally (e.g., hemoglobin). Another possible cause for anuria in air-raid casualties receiving sulfapyridine is the formation of calculi at the ureterovesical junction. None of these seemed to be of primary significance in the cases cited.

The part played by transfusion fluids must be considered, inasmuch as the pathological changes resemble closely those of the "transfusion kidney." There was no evidence clinically of a transfusion reaction, although such can occur in the absence of one or, rarely, all of such symptoms as rigor, chill, backache, and jaundice. Plasma samples taken at seventeen and a half and forty hours after transfusion showed no increased color. The most potent argument against their being due merely to transfusion reactions is that no such condition has occurred in any of 25 shocked and injured patients without severe muscle crush treated in the same hospital by blood or "serum" transfusion.

The treatment of this condition so far has been by trial and error. It has been directed primarily to restoring the urinary output by means of heat to the loins, saline dilution of plasma protein, increasing the blood volume with serum and hence increasing the blood pressure (also the glomerular capillary pressure), and the use of diuretics such as caffeine. Decapsulation should perhaps be tried, as it has been shown to reduce the intrarenal pressure (Winton, 1937). In transfusion kidney this has been done twice with successful results (Bancroft, 1925; Younge, 1936).

The effect of adrenal cortical extract in this condition should also be observed, in view of the raised potassium. Prevention by early amputation was thought adequate in 1 case but thirty-six hours was not early enough. Whether an alternative to immediate amputation exists shall be learned only by further and fuller investigation of such cases and by careful observation of the effects of treatment, or if the condition can be reproduced in the laboratory.

BEALL, BYWATERS, BELSEY, and MILES report a case in which additional studies of the kidney were made. In frozen sections no trace of fat was found either in the tubules, cells, or capillaries. These sections did, however, show that the pink material in the tubules and glomeruli filled the spaces more completely than it appeared to do in the paraffin sections. Many stains were tried in an attempt to identify the material in the tubules and glomeruli, but without success apart from a positive stain for fibrin (Weigert's fibrin stain). The material giving a positive stain appeared only in the distal part of the tubules and never in the glomeruli in this kidney. The brown material did not give a positive reaction for free iron.

MAYON-WHITE and SOLANDT reported the case of a patient who died from uremia following a type of injury that often produces shock. Unlike similar cases reported, no blood was given the patient, hence renal damage from incompatible blood was excluded as a cause.

The Medical Research Council reported 11 additional cases. All the patients were pinned under débris for a period between three and twenty-six hours. In 6 fatal cases death occurred in from five to ten days. Hypertension, blood-stained urine, oliguria, and edema of the crushed limbs were the outstanding clinical features. In 3 of 5 patients who survived, blood was found in the urine and in the 2 others, without hematuria, the urinary output rose to normal on the fifth and sixth days, respectively. In 1 case without intravenous therapy the blood pressure rose to 176/110. In this group which survived, the degree of swelling and the duration of crush differed little from the fatal cases.

In future cases particular attention should be paid to: (1) the presence of anesthesia or whealing; (2) edema, its daily extent and progression (circumference measurements); (3) the pulse in the limbs, and, if possible, oscillometric readings; (4) the blood pressure, initial and daily readings; (5) initial hemoglobin measurements and biochemistry of the blood (serum for potassium and urea); and (6) the urine, daily attention from the time of entry should be given to the quantity, color, and the presence of blood, albumin, and casts.

MANUEL E. LICHTENSTEIN, M.D.

Debrunner, H.: Gunshot Fractures (Ueber Schussfrakturen). *Schweiz. med. Wchnschr.*, 1940, 2: 1015.

The old classification of definite fracture types suggested by Bircher has no significance when applied to modern war injuries. The modern shotgun wound is a comminuted fracture by shell splinters of diverse shapes. It is, without exception, an injury of the most severe character with extensive wounding of the bone and soft parts. In the fractures of the extremities the localization plays a more important role than the character of the break. The gunshot injuries of bones close to the body and of the joints, due to their more menacing character, are allotted greater attention. Modern war injuries are most nearly paralleled by the open fractures of modern transportation accidents.

The first rule should be immobilization of the bone injury. Modern warfare has shown with particular clarity that this measure is of extraordinary importance for both shorter and longer transportation. Wound revision can nearly always be undertaken first in the front line hospital. It is to be emphasized, however, that this first immobilization is not to be compared with reposition of the fracture fragments, this being undertaken only after remission of the acute wound conditions. For example, the mortality of gunshot fractures of the thigh during the World War, after introduction of the extension-splint of Thomas, fell from 90 to 20 per cent. The plaster-of-Paris splint in its classical form is of great significance in modern transport from the front toward the rear. Fixation and extension are two entirely different conceptions. Continuous extension is possible only when the pull and counterpull can be endured by the patient. Extension is done for reposition. However, it cannot replace fixation. Fixation alone guarantees excellent conditions for healing. Modern extension treatment can be carried out only under stationary clinical conditions. Extension splints have not stood the test for long and medium long stretches of transportation. The patient with a plaster splint endures a long journey incomparably better than one in an extension splint.

The author then discusses the different measures for good fixation. He recapitulates briefly the points which must be observed in the application of a plaster dressing. Unpadded plaster splints should be applied only by those trained in this work. He draws attention particularly to the extension plaster dressing of Gocht. The healing of a gunshot wound depends first on the character and grade of the infection, second on the size and localization of the osseous destruction, and third upon secondary factors such as the general condition, collateral injuries, nerves, and vessels.

The author discusses the bases whereby an infection and pseudarthrosis may arise. He recommends that in the toilet of the wound not all bone splinters be heedlessly removed, and that all fragments which have any adherence to the surrounding soft parts, above all to the periosteum, be left in the wound. Animal experimentation has convinced the author that bone defects up to 8 mm. in breadth will close with osseous union, but those of 10 or more millimeters will not heal. In the latter cases the bone ends seek to establish a bridge-like callus with the

neighboring bone. In the opinion of the author the tissues lying between the ends of the fragments undergo a metamorphosis, which follows the laws of mechanical functioning. This influence is localized, and reaches only over a certain distance. Apparently hormonal influences are decisive. Interposed soft parts lead to defect-pseudarthrosis. It has been shown, however, that only interposed tissues which are living provide an unsurmountable barrier for the development of the callus; tissues which have died will later be penetrated by callus.

In concluding, the author takes up the still little elucidated development of pseudarthrosis. In this connection, he recalls the chronic fractures of soldiers on the march and other fractures due to overloading (the Looser transition zones, manifestations of insufficiency according to Henschen). The discrepancy between the functional capacity and the functional demand injures the bone, so that at the point of greatest stress a de-ossifying process occurs. It is certain that in the production of pseudarthroses mechanical factors are decisive. On the other hand, metabolic studies have clearly indicated the collaboration of inner secretory and other disturbances.

The author believes that disturbances of stress within the callus arise as a result of failure to concentrate sufficiently in fracture treatment on the attainment of good fixation, or failure to combine the extension with good fixation. Extension should be replaced as rapidly as possible by fixation.

(Schweizer). John W. Brennan, M.D.

Penfold, W. J., Tolhurst, J. C., and Wilson, D.: Active Immunization Against Gas Gangrene and Tetanus. *J. Path. & Bacteriol.*, 1941, 52: 187.

A method is given for the concentration of bacillus-welchii toxin with acetic acid and sodium chloride.

With alum-precipitated toxoids, combined immunity against bacillus-welchii culture and bacillus-tetanus toxin has been obtained in guinea pigs.

Reports on the use of toxoid vaccine mixtures in animals and man have been summarized. On the evidence presented, there seems to be no reason why the immunization of man with a mixture of T. A. B. vaccine and tetanus and bacillus-welchii toxoids should not be successful.

The immunization of man with bacillus-welchii (Type A) alum-precipitated toxoid is discussed. In a total of 12 persons receiving 33 injections in all, reactions were mild and local. It is possible that these mild reactions were due to traces of formic acid in the formalin used to prepare the toxoids. All the volunteers responded with the production of antitoxin in their serum, and human serum injected into mice protected them against living cultures of bacillus-welchii. As with all immunizing agents, there is a great individual variation in both animals and man as to the amount of antitoxin produced. In the volunteers, the maximum response following either 2 or 3 injections varied from .05 to .5 unit of antitoxin per c.cm. of serum.

The use of this antigen in the Army as a prophylactic against gas gangrene is suggested.

Samuel Kahn, M.D.

Lenner, S.: Experiences with Gas Gangrene in the Field. From a Field Hospital in the West (Erfahrungen mit Gasbranderkrankungen im Felde. Aus einem Feldlazarett im Westen). *Chirurg*, 1940, 12: 481.

On the western front the author saw 750 wounded, 18 of whom had definite gas gangrene. The great majority of infections occurred in splintered wounds caused by grenade and especially by mine splinters. The author is of the opinion that a portion of the infectious material is destroyed by the highly heated grenade splinters. He has not seen gas gangrene due to pistol, rifle, or machine-gun bullets, even when large shreds of shoes or clothing were carried into the wound along the bullet tract.

The site of the wound or situation of the focus of infection is of great significance in the prognosis of gas gangrene. Infections of the trunk are far more difficult to evaluate than are those of the extremities. The greatest potentialities for the development of gas gangrene are found in large mangled sinuated wounds with large areas of destroyed tissue. The prognosis of gas gangrene in the extremity depends upon whether or not the infection is located superficially or deep in the fascia. The fascia forms a safe barrier against penetration of the deeper tissues.

Infection occurs as soon as the wound is made. The author saw cases of gangrene in wounds when they were first treated at the hospital, even six hours after the injury. The patient complains of increasing, often intolerable, pain. The occurrence of pain is preceded by a painfree stage. The pulse parallels the temperature and the latter may be elevated to 38.5° (C.) in this stage. The frequency of a sick mien is in striking contrast to the maintenance of pulse and temperature curves. The author emphasizes another symptom, namely, the almost typical odor of gas gangrene. It is an obtrusive offensive putrid odor, similar to the odor of decayed dead material. If crepitation of air and dark brown discoloration of the skin are present the diagnosis is certain.

Four of the 18 patients with gas gangrene died. Amputations were necessary in 4 cases (2 of the thigh and 2 of the lower leg). The remaining cases were treated by adequate wide splitting of all the tissues, especially of muscle pockets; extensive counter incisions to the dependent parts; and wide opening and drainage of the wounds. The splitting of fascia must be made especially extensive.

Gas gangrene is an anaerobic infection. It can develop only in the absence of oxygen. One must not permit any condition essential to the life of the causative organism to exist. For this reason, closure of a war wound by suture is to be regarded as a grave error. A war wound should be kept widely open. One must strive not to close the wound but to split it open. Free egress of secretions must be

guaranteed. This cannot be attained by packing but only by adequate drainage. The dressing should be absorbent. A dry dressing is preferable to one that contains an ointment or greasy substance. Dressings with Dakin's solution or Rivanol solution have sometimes proved satisfactory. The changing of bandages is painful and for this reason should be done under evipan anesthesia. Not infrequently additional later incisions and opening of new pockets may be necessary.

When the patient's life is endangered and the progression of infection can no longer be controlled by incisions, preservation of the extremity should be forsaken. The best type of amputation incision is a simple circular section or amputation. However, it is of utmost importance to leave the wound open. Any suture is strictly forbidden. Any artificial formation of flaps is a mistake. The end result of the stump is not a problem of the field hospital. Excessive retraction of the soft parts can be counteracted by "mastizol" traction dressing.

The author has not used gas-gangrene serum either prophylactically or therapeutically. He has utilized multiple blood transfusions instead. In virulent cases these transfusions have been of no value and in other favorable cases he has not been convinced of an immediate influence of the blood transfusions upon healing. He has been convinced repeatedly that the important factor in treatment is to rely upon timely diagnosis of the infection and surgical care. (ZILLMER). EDWARD W. GIBBS, M.D.

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

McMichael, J.: Circulatory Collapse and Wound Shock. *Edinburgh M. J.*, 1941, 48: 160.

The author summarizes the physiological mechanisms of shock in the following outline:

Disproportion between the content and capacity of the vascular system (reduction of blood volume or increased capacity of the smaller blood vessels)
↓
Diminished pressure in the great veins near the heart
↓
Decreased diastolic filling of the heart
↓
Decreased cardiac output (Starling's Law)
↓
Fall in the blood pressure
Decreased pressure in the carotid sinus
↓
Acceleration of pulse—"Compensatory" sympathetic vasoconstriction (skin and visceral pallor) sweating (sympathetic stimulation)

Recent air raids in England have broadened clinical experience in shock. The author describes three types of cases to illustrate the major problems: (1) shock due to loss of plasma constituents; (2) shock due to hemorrhage; and (3) shock due to hemorrhage combined with plasma loss.

Trauma leads to blood loss and "plasma" transudation in the injured area. As a result of the lowering of plasma and blood volume, a severe depression of cardiac output occurs which results in oxygen deprivation. Oxygen deprivation leads to a further increase in capillary permeability. This makes treatment difficult, as plasma is not retained. In favorable cases, however, the deleterious effect on capillary permeability is reversed if a good state of the circulation can be maintained. Early treatment and assiduous and continuous attention are necessary in the management of shock to secure this end. If the serum transfused is not retained, as will be shown by rising hemoglobin and falling blood-pressure figures, further transfusion must be given.

Determinations of the pulse rate are important in evaluating the degree of deterioration in cases of circulatory collapse, and in a general way this also holds in shock. A rising pulse rate corresponds to the fall in blood pressure and blood volume. However, racing pulse rates are seldom encountered even in severe shock. Pulses from 100 to 120 are common, but more rapid pulses are rare. Slow pulses, however, are encountered and these do not exclude shock. Furthermore, the pulse may not fall much with the restoration of blood pressure in treatment. It often continues to be rapid for a day or two after the blood pressure has been restored to a satisfactory level.

The biochemical changes in shock include the following:

1. An increased permeability of capillaries may be indicated by a rise in plasma proteins and a leakage of albumin from the blood.

2. Rising blood urea is common to a number of conditions of cardiovascular collapse, hematemesis, diabetic coma, and the crises of Addison's disease. High values are also encountered in shock, but not so high as those in hematemesis.

3. Rising serum potassium and falling sodium and chloride are important factors. These changes only appear after the blood pressure has been at a low level for a long time. In many instances they are ante-mortem changes. The distribution of inorganic ions is normally sodium and chloride extracellularly, and potassium and phosphate intracellularly. As death approaches, it would appear that this important differential cell-membrane permeability is lost, with a resulting rise in the serum potassium and fall in sodium. Suprarenal cortical hormone and sodium-chloride injections have been recommended for the treatment of this change, but so far without much success. The essence of our therapeutics should be to prevent these changes by the early treatment of shock.

A clinical picture of "toxemia," similar to that seen following severe burns, has been noted following prolonged crushing injuries. This course of events consists of hemoconcentration, vomiting, alternating drowsy disorientation and mental clarity, progressive rise of the blood urea, and fall of plasma chloride. Serum potassium is high from an early stage. It is

suggested that biochemical changes result from profound renal insufficiency which is in some way dependent on the restoration of circulation through dead muscle tissue. Another theory is that the transuded fluid in traumatic edema may develop lethal properties.

Primary shock, not necessarily associated with severe injury or even with any injury presents a slow pulse and low systolic blood pressure, and must be differentiated from severe secondary shock. This stage usually recedes with rest alone. It is possible, however, that it may persist until secondary shock develops and confuses the picture.

Shocked patients should be treated in a special resuscitation ward. General measures such as relief of pain, arrest of hemorrhage, warmth, raising the foot of the bed, and the administration of fluid are well known. The author also emphasizes the following points:

1. Early and adequate transfusion. Blood, plasma, or serum should be given *until the blood pressure is normal*, and if the blood pressure falls again further transfusions must be given.
2. Administration of oxygen.
3. Limitation of transudation by bandaging and elevation of crushed limbs.
4. Proper local treatment of injuries.

SAMUEL H. KLEIN, M.D.

Linde, S.: Postoperative Thrombo-Embolism, Frequency, Time of Occurrence, and Duration of the Course of the Disorder. A Statistical Investigation (Postoperative Thrombose-Embolie-Komplikationen, Frequenz, Zeit des Auftretens und Dauer des Krankheitsverlaufes. Eine statistische Untersuchung). *Acta chirurg. Scand.*, 1941, 84: 310.

Linde states that the steady increase in the use of heparin as a preventive means against postoperative thrombosis has also forced other relevant questions into the foreground, i.e., the frequency of postoperative thrombosis and its effect on the mortality and on the duration of the patient's sojourn in the hospital after the operation. In an attempt to elucidate these problems statistically, he has used the material of the surgical sections of the Maria and Sabbatsberg Hospitals of Copenhagen for the years from 1934 to 1939, inclusive.

The total material amounted to 11,401 cases. Evidently, it was out of the question to go through each individual history, and therefore the number of thrombo-embolic cases was taken from the diagnoses given, but subsequent review of the cases with normal course showed that in a number of patients with thrombo-embolism the diagnosis had not been given for some reason or another. Consequently, in certain large groups, like those of cholecystectomy, appendectomy, and radical intervention for inguinal hernia, hydrocele, and varicocele, the frequency of the thrombo-embolic complication given in the table is undoubtedly somewhat too low. On the other hand, the mortality figures correspond to the actual facts. There were 259 cases of thrombo-embolism, or 2.3 per cent, and this complication was the cause of death in 41 cases, or 11.3 per cent of the total fatal cases after operation. Forty-five cases of thrombo-embolism were found at necropsy: in the 4 additional cases, the complication was only an accessory finding.

In the estimation of the duration of the hospital stay of the patients, only true cases of thrombo-embolism and those in which it was the sole cause of the prolongation of the hospital stay were taken into consideration. About 13 per cent of the patients were younger than thirty years, while 87 per cent were older. The symptoms of the complication appeared in general about ten days after the operation; the shortest time of appearance was two days. The duration of the hospital stay beyond the normal period varied for individual groups, but remained within rather narrow limits for most groups: for cholecystectomy thirty-nine days, for appendectomy forty days, for appendectomy with drainage forty-two days, for abdominal and similar operations forty-three days, and for varicose vein extirpation thirty-nine days. The average prolongation of the hospital stay beyond the normal period for the 259 mixed cases of thrombo-embolism was from thirty-seven to thirty-eight days. RICHARD KEMEL, M.D.

Pettersson, G.: Three Cases of Pulmonary Embolism on the Operating Table (Drei Faelle von Lungenembolie auf dem Operationstisch). *Acta chirurg. Scand.*, 1941, 84: 321.

In its various forms, embolism is a rightfully feared surgical complication, even though it occurs rarely. Surgery in itself may reveal the direct cause of embolism, as for instance in the majority of cases of air embolism. Cases in which foreign bodies such as bismuth salve and oil are introduced into fistulous tracts or canals for therapeutic or diagnostic purposes and thence reach the blood vessels may also be included in this category. Even autogenous material may produce emboli during an operation, for instance, fat emboli during orthopedic operations; tissue and tumor emboli are also imaginable. Pulmonary emboli may be produced by the separation of a thrombus during an operation. The observation of 3 such cases leads the author to believe that this surgical complication has not received sufficient attention.

In the author's first case a woman with a large intraligamentous myoma came to operation after three days of subfebrile temperature. A supravaginal uterine amputation was done and during the peritonealization of the operative cavity the patient suddenly stopped breathing and became pulseless. Autopsy revealed pulmonary embolism and a fresh thrombus of the same color as the embolus in the left iliac vein.

In the second case a woman with acute hemorrhage in a hypernephroma suffered thrombosis one week after an exploratory laparotomy. Four weeks later, after she had been up for four days, the second operation was done. During the nephrectomy a pul-

monary embolism occurred and the patient died on the table. The autopsy revealed emboli in the pulmonary artery, and pulmonary metastases as well as thrombi in the left saphenous vein and the right ileohypogastric vein.

In the third case a woman with a large intrathoracic struma showed symptoms of compression. She was in bed for eleven days before the operation with a subfebrile temperature, and a pulse falling from 85 to 75. During the operation under local anesthesia the patient lost consciousness during the separation of the struma; respiration ceased and the pulse weakened. Artificial respiration brought about some improvement and the operation was completed. Signs of bronchopneumonia developed and death occurred on the fourth day. Autopsy revealed pulmonary infarcts of about four days' duration.

All of these 3 patients had large tumors situated in the immediate vicinity of large venous stems, in which the impairment of the circulation is a strong factor favoring thrombosis. In the second and third cases the thrombosis did not develop immediately toward the periphery of the blood current. The explanation for the occurrence of the embolism just at the time of the operation may lie in the fact that in 2 cases the emboli appeared during the blunt separation of the tumor. In Case 1 the direct traumatization of a thrombosed vein may have been the exciting cause, but in Cases 2 and 3 the tugging and dragging on the tumor may have produced a suction and pressure in the adjacent vessels, which resulted in mobilization of the distant thrombus. Comparison of the author's cases with those of the literature points to the suggestion that pulmonary emboli appearing during the operation occur in 2 operative groups of cases: (1) in extirpation of large tumors situated in the body cavities near large venous stems, and (2) in amputations of the thigh because of septically infected, severe injuries of the lower extremity. They may occur also in other groups of cases, but in the two groups mentioned they should be thought of particularly.

All of the author's cases showed a pre-operatively increased temperature, which was not attributed to the thrombosis in Cases 1 and 3, but in Case 2 there was a manifest thrombosis of the left femoral vein four weeks before the last operation. The pulmonary embolism as such was determined only at the autopsy of Case 1; the diagnosis of embolism was considered possible at operation, but not probable, as the patient felt perfectly well. In Case 2 the diagnosis of embolism was made immediately after the operation because of the preceding thrombosis and its sudden onset during a quiet anesthesia. In Case 3 the embolism was suspected because of the site of the operative area, but typical symptoms of pulmonary embolism were not observed, and in the further course the diagnosis of pulmonary infarct was not made. The symptomatic picture of pulmonary embolism in a narcotized patient differs from the usual picture only insofar as there are no subjective symptoms. In Cases 1 and 2 with obturating emboli, the picture was characterized by the sudden onset of the cessation of respiration and the pulse. In Case 3 (under local anesthesia), in which the site of operation was in the anterior mediastinum, the pulmonary embolus was not obturating; these facts and the unrest of the patient may explain why the embolus was first observed when the respiration ceased and the pulse became poor. The author believes that a non-obturating pulmonary embolus gives very insignificant or absolutely no symptoms in a narcotized patient. Case 3 also shows that the diagnosis of pulmonary infarct after an operative embolus may be easily overlooked, and the author suspects that among the postoperative pulmonary complications appearing one or two days after operation, a pulmonary infarct, due to small, non-obturating pulmonary emboli which have appeared in an anesthetized patient during the operation may occasionally be missed.

The diagnosis of pulmonary embolism during the operation offers great differential diagnostic difficulties, as the emboli occur usually in anesthetized patients. General anesthesia may be complicated permanently or transiently by cessation of the respiration and pulse weakness. This observation was made very often during the chloroform era, but less often after the transition to the use of ether and nitrous-oxide anesthesias. In the latter it has been shown experimentally that in certain cases there is a hypersensitivity of the carotid sinus, so that pressure on the same may produce cessation of respiration and transient circulatory disturbance. This finding has led to the conclusion that in man it may lead to death. In these cases the pressure would be produced by the hands of the anesthetist who draws the jaw of the sleeping patient forward. To a certain extent, the same may be said of the injection anesthesias. In spinal anesthesia, severe shocklike intervals occur occasionally, often in the first twenty minutes and usually before the operation has begun. The absence of local thoracic symptoms excludes mistaking such an occurrence for a pulmonary embolus. It should be remembered that the pulmonary embolus in the cases described heretofore always appears suddenly and unexpectedly during a quiet anesthesia. It should also be remembered that deaths from anesthesia are due to an overdosage. The diagnosis of death from anesthesia must never be made without a previous autopsy, with special attention to the possibility that an embolus may be the cause of death.

In differentiating between death from thromboembolism and death from air embolism occurring during an operation there is less difficulty. The pictures of venous and air embolisms differ. With the onset of the venous air embolism there is heard in the majority of cases a lapping or churning sound, followed immediately by a rippling or gurgling murmur over the heart. Dyspnea, unconsciousness, and deep cyanosis or marked pallor occur. The pupils dilate, the reflexes disappear, and the pulse rapidly becomes weaker. If death occurs only after one or two hours,

a transient improvement of the cardiac activity and respiration may take place. The arterial air embolism occurs only in interventions on the thorax or lungs. The symptomatic picture is controlled by symptoms of the central nervous system: clonic and tonic cramps, convulsions, pareses and plegias, visual disturbances, and disturbances of the cardiac activity and respiration. A localized marmorization of the skin, air vesicles in the arteries of the eye ground, or sector-like anemia of the tongue confirm the diagnosis.

Fat embolisms are rare as a complication in bloody operations and have been seen almost solely in operations on the skeleton. The symptoms appear only from a few hours to one-half day after the operation. Dyspnea, cyanosis, a rising pulse frequency, a diminishing blood pressure, a rising body temperature, and unconsciousness complete the picture of a fatal fat embolism.

Tumor embolisms can occur only in operations for hypernephroma. Aside from the structure of the embolus, there are no basic differences from a thrombo-embolism of the same size.

The most important treatment in these cases is prophylactic. If possible the patient should be up and around daily up to the day of operation. If rest in bed is necessary for any reason, pre-operative heparin therapy should be instituted. The possible presence of a thrombosis should be carefully investigated before the operation; the examination should include the local findings, the temperature and pulse curve (climbing pulse), the blood sedimentation rapidity, the skin temperature, and venography. If thrombosis is present, two procedures are available; the choice depends upon the gravity of the indications for the operative treatment of the basic condition: one can wait until the thrombus has had time to organize or remove the thrombus surgically. In the first instance one must wait several months, as Case 2 showed that one month was too short an interval. In order to proceed surgically the thrombus must lie in the saphenous, femoral, or iliac vein. Kulenkampff has divided the saphenous vein and has extracted the thrombi in the femoral and iliac veins from there. Fruend has opened the femoral vein and removed the thrombi; in 2 cases he also ligated the femoral vein. Laewen exposed the femoral, the external iliac, and the common iliac veins; temporarily clamped the common iliac vein; and withdrew the thrombus through an incision in the femoral vein. Kulenkampff considers the clamping of the common iliac vein as superfluous, as the positive venous pressure prevents embolism.

In septic thrombophlebitis an extensive operation, such as amputation, may have to be preceded by ligation of the veins as centrally as possible beyond the thrombus. If the diagnosis of septic thrombophlebitis is uncertain, the risk of an exploratory incision over the femoral vein may be taken to determine whether a thrombus exists or not.

If a pulmonary embolism has already occurred on the operating table, the usual injection therapy and artificial respiration, are indicated. Only after these measures fail, is the Trendelenburg operation indicated. LOUIS NEUWELT, M.D.

Robb-Smith, A. H. T.: Pulmonary Fat Embolism; Pathology, Pathogenesis, Therapeusis, Clinical Material, Case Histories. *Lancet*, 1941, 240: 135.

Pulmonary fat embolism is regarded as an uncommon complication of a fracture of a long bone. A study of a series of deaths following accidents reveals that it is an almost constant finding, and in many cases is probably a major factor in the fatal outcome. In severe injuries, the importance of the various factors—shock, blood loss, visceral contusion, and displacement—is difficult to assess. The frequency of fat embolism as a morbid anatomical finding suggests that it is one of these factors, and should encourage its clinical recognition and treatment. Conditions which may induce fat embolism range from a severe shaking without bony injuries to multiple and compound fractures; it is also to be found after severe burns and in certain cases of poisoning, particularly with alkalies and, rarely, after manipulative operations and the therapeutic injection of oils.

The symptoms of pulmonary fat embolism arising from injuries come on after a symptom-free interval varying from a few hours to several days. The patient becomes dyspneic, pale, cyanosed, and restless, and, with little coughing, brings up frothy sputum which may be blood-stained. Fat emboli in the systemic circulation may produce purpura, or cerebral symptoms such as stupor, fits, or palsies. The blood pressure does not fall. The clinical picture may be mistaken for surgical shock or internal hemorrhage, the cerebral symptoms may simulate cerebral contusion, and the purpura may be confused with the purpura of septicemia. The diagnosis should be considered in all cases of injury developing pulmonary or cerebral symptoms. A characteristic feature is the "symptom-free interval"—a period varying from a few hours to two days, during which the patient's condition apart from the injury is comparatively good. Symptoms developing after five days are unlikely to be due to fat embolism. Examination of the unfixed fresh sputum, stained by adding a few drops of an alcohol-acetone solution of Sudan III, shows free fat droplets present in addition to fat-containing alveolar phagocytes. Lipuria, when present, is not usually found until a week after the accident. The presence of fat globules in the retinal vessels in severe cases of fat embolism has been noted in rare instances.

The post-mortem diagnosis of pulmonary fat embolism is most readily confirmed by the examination of a fresh preparation. Snippets of lung placed on a slide and covered with a few drops of 2 per cent potassium hydroxide show the fat lying in the alveolar capillaries as cylinders, or in a racemose formation. The fat emboli are refractile and show a narrow dark edge, whereas air bubbles are found to be more highly refractile and have a broad dark rim. In patients dying in the late pneumonic stage very

little fat may be found in the capillaries, but much may be found in the alveoli, and it may then be difficult to distinguish this appearance from that found in inhalation pneumonia, though in the latter condition fat is never found within the capillaries. The examination of fixed tissue shows capillary congestion with intra-alveolar hemorrhages and edema alternating with zones of emphysema. In paraffin sections, the breaks in continuity of the columns of erythrocytes in vessels may be noted, but frozen sections stained for fat reveal the branching emboli of fat and, in the later stages, fat, both free and in alveolar phagocytes, in the alveolar lumina. In a number of patients who died shortly after a severe injury, the lungs showed no gross changes, yet microscopic examination revealed massive fat emboli. It is probable that in these cases the circulation ceased before the tissue changes induced by the emboli developed. In a patient who died suddenly, large masses of fat were lodged in the pulmonary artery in a similar manner to a thrombus dislodged from a vein. It appears that the fat is entirely derived from released tissue fat entering the circulation from the traumatized area, although, as a result of the trauma, there may be a change in the physicochemical state of the normal blood fats with a loss of emulsification. It is conceivable, too, that traumatized tissue may release a lipoproteinase which splits the lipoprotein complexes of the blood. It is not known for certain whether death in fat embolism is caused by a general anoxemia because of the interference with respiratory function, local anemia of a vital center due to a fat embolus, cardiac failure due to physical pulmonary obstruction, or a neurocardiac mechanism. Elucidation of this problem is essential if rational therapeutic measures are to be adopted.

In the prevention of fat embolism the most important measure is early immobilization of the injured region with a minimum of manipulation. Active treatment is directed toward the relief from anoxemia with oxygen administered either by mask or by tent. The value of atropine is doubtful and it is also questionable whether stimulants like coramine are of value. Morphine is too depressant, but the barbiturates are the least harmful of the effective analgesics. In the presence of shock, fluids may be administered intravenously, but with the onset of the symptoms of fat embolism, intravenous fluids should be discontinued, since right heart failure is frequent. The use of adrenaline, bile salts, and ether to prevent the passage of fat through the lungs into the systemic circulation or to convert it into a harmless state, has not been established. A single injection of 10 c.cm. of 20 per cent sodium desoxicolate solution was given in one case. The patient's pulmonary condition improved rapidly but he developed cerebral fat embolism from which he died. The development of pneumonia requires its usual treatment.

The pulmonary symptoms which arise from exposure to the blast of a high explosive may be due to a combination of pulmonary concussion (a term preferable to "blast injury" or "pulmonary contusion") and fat embolism. Fat emboli should be specifically looked for in autopsies on air-raid casualties. If their frequency is confirmed, the treatment of such cases may have to be revised.

Of 789 consecutive patients meeting with accidents, 125 died; of these 41 had gross pulmonary fat embolism, and in 29 this condition was thought to have played a major part in causing death. Of the patients who died, 12 had no bone injury, but 6 of these appeared to have died from fat embolism, including 1 air-raid casualty.

MANUEL E. LICHTENSTEIN, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Crawford, A. S., and Hoopes, B. F.: The Surgical Aspects of Lightning Stroke. *Surgery*, 1941, 9: 80.

The authors quote death statistics of the largest area of the United States, showing that in the period between 1924 and 1933 there were 3,849 deaths due to lightning. The mountain and southern states had the highest death rates, while the northeast and middle Atlantic states had the lowest.

Burns are the most common lesions due to lightning stroke, and may be of any degree of severity. The burns may be of bizarre pattern such as arborescent markings, long narrow lines, localized surface burns, and burns made in shapes determined by metal objects in the clothing or pockets. Associated with the burns, large lacerations may be caused by the explosive force of the lightning stroke. The most frequented organs of special sense that have been affected by lightning stroke are the ears and eyes. Cataracts have been noted with some degree of frequency. Lesions of the nervous system following lightning stroke are often bizarre and varied, ranging from muscular weakness to complete paralysis. Various types of pathological changes are observed in the nervous tissues, and all degrees and types of nerve degenerations and injuries.

The authors found reports in the literature of 5 skull fractures caused by lightning stroke, and 1 case in which a sequestrum was spontaneously extruded three months after the injury. They report 1 case of their own in which a patient was evidently struck by lightning while standing against the metal sink in her kitchen. She was admitted to the Henry Ford Hospital approximately one and one-half hours after the accident. She was unconscious and could not be aroused. They stated that the general appearance of the patient was that of profound shock. Nevertheless, the blood pressure was 120/80, her pulse 72, and respiratory rate 20 per minute. She had several metal hair curlers in her hair, but there were no burns under these. The right ear was almost completely avulsed, and the mastoid bone apparently blown open, its edges jagged and charred. Sanguineous spinal fluid dripped briskly from the canal of her right ear. There were burns of the chest wall and of both wrists. The patient regained consciousness six hours after the accident. The areas

were débrided and sutured, and the burns treated in the usual manner. Sulfanilamide was administered as a prophylatic measure against meningitis, which was expected, and did occur. Rapid spinal drainage was carried on for six days, after which the patient apparently proceeded with a normal convalescence.

The authors state that this is the first reported case of recovery from a skull fracture with brain injury resulting from a lightning stroke. They believe that the prophylactic use of sulfanilamide prevented a septic meningitis.

WILLIAM C. BECK, M.D.

Marble, H. C.: Purposeful Splinting Following Injuries to the Hand. *J. Am. M. Ass.*, 1941, 116: 1373.

Rest is the greatest therapeutic agent known in superficial abrasions, burns, and infections of the hand. Splinting in a neutral position, elevation, and rest in bed are essential in treating these injuries.

Fractures of the wrist and hand should be splinted as follows: Colles' fractures in flexion pronation; carpal fractures with the wrist in extension, the metacarpal bones fixed in extension, and the fingers permitted to fall into the position of flexion; fractures of the metacarpal bones with all fingers in the extended position; phalangeal fractures in flexion, or they may be treated by means of traction and a banjo splint.

Splinting following the repair of tendons is extremely important. The splint should be applied so as to relieve all tension on the injured tendon. In the event of lacerations of the extensors, the wrist and metacarpophalangeal joints must be splinted in complete extension. In flexor-tendon injuries, splinting must be done with the wrist, fingers, and thumb in flexion.

In radial-nerve injuries, the wrist, metacarpophalangeal joints, and thumb must be splinted in full extension. If the ulnar nerve is injured, the thumb must be splinted close to the index finger (adductor relaxation), the metacarpophalangeal joints flexed at right angles (interossei and lumbrical relaxation), and the middle finger semiflexed. Injury to the median nerve requires that the opponens muscles be relaxed, i.e., the thumb brought into the palm of the hand so that it points to the ring finger, and the fingers held in extension.

Contractures following injuries can often be overcome by a slow, steady, slight pull with garter-elastic traction.

Various materials for splints are discussed. The advantages and disadvantages of wood, sheet aluminum, plaster-of-Paris, castex, and thermex are pointed out.

The author emphasizes the important fact that no form of physical therapy supplants active voluntary use of the hand in restoring function. Active motion is started early, often with the splint in place.

No harm results from this procedure and optimum end-results will be obtained.

LUTHER H. WOLFF, M.D.

Allen, H. S.: The Treatment of Superficial Injuries and Burns of the Hand. *J. Am. M. Ass.*, 1941, 116: 1370.

Injuries to the skin and subcutaneous tissues of the hand are divided into two groups, i.e., those which are sharply lacerated, and those resulting from crushing or avulsion injury.

Open wounds should be converted into closed ones as early as possible. Wounds seen within six or eight hours from the time of injury may be safely converted into closed wounds except when they have been injudiciously tampered with, or when they have been received at the autopsy or operating table or from a mouth bite.

A simple sterile dressing, with light sustained pressure if bleeding is active, is the only emergency care a wound needs. A splint may be applied for transportation.

The care of the patient with a hand injury in the emergency operating room is described in detail.

Aseptic procedures are essential. The entire personnel should be properly masked, gowned, and gloved, as infection from droplet contamination frequently occurs. The area of skin surrounding the lesion is thoroughly shaved and cleaned with simple white soap, cotton pads, and copious amounts of water. After the preliminary cleansing the gowns, gloves, and solutions are changed and the wound itself is thoroughly but gently cleansed with soap and saline irrigations. A blood pressure cuff is then applied and inflated to 260 mm. of mercury. Gloves are again changed, and the wound is draped.

After anesthesia (general or local) has been obtained, the wound is carefully débrided, warm saline solution being used for mechanical cleansing. The diagnosis of the extent of the lesion is made and the structures involved are ascertained. Blood vessels are ligated and, with gentle handling of the tissues, the subcutaneous tissues are repaired with fine silk and the skin is closed with horsehair. A large soft pressure dressing is then applied, and the extremity splinted.

Crushing or avulsion injuries to the hand are more serious and may result in serious impairment of function.

General anesthesia is desirable for the repair of these wounds, since local anesthesia tends to further impair the circulation. The blood pressure cuff is usually not used. Débridement is extensive until normal bleeding or tissue of good color is found. If the skin cannot be closed without tension, an immediate graft of intermediate thickness is applied. At times pedicle or pocket flaps of the abdomen or thigh are useful in covering raw surfaces. A large firm dressing is applied after the closure to prevent secondary edema, venous stagnation, and hematoma formation. The hand should be immobilized with splints. Crushing wounds which do not produce lacerations (such as wringer injuries) should have a large pressure dressing applied, and the extremity should be splinted to prevent progressive hematoma formation.

Burns of the hands are best regarded as large, open surgical wounds. A sterile dressing only should be applied as an emergency measure. Later, after general care of the patient, the burn is thoroughly cleansed aseptically. The burned member is placed in warm circulating water, blebs and loose tissue are cut away, and the burned areas are washed and flushed with sterile saline solution. The burn is then covered with petrolatum gauze, and a large, soft firm dressing is applied, with the fingers separated and the hand splinted in the position of function. Dressings are left undisturbed for a period of fourteen days, after which crusts and exudates are removed with moist saline or hypochlorite pressure dressings which are changed daily. As soon as the crusts separate and granulations appear healthy, a skin graft is applied.

In all injuries of the hand, rest of the part is insured by splinting and non-interference with the dressing when there is no indication to interfere.

LUTHER H. WOLFF, M.D.

Childress, H. M.: Subfascial Hematoma as a Complication of Crushing Injuries to the Foot. *J. Bone & Joint Surg.*, 1941, 23: 251.

Crushing injuries to the dorsum of the foot usually produce marked hemorrhage in the subfascial spaces regardless of whether fractures of the foot bones also occur. The resulting circulatory disturbance is prompt and may be sufficiently severe to produce permanent damage unless relieved immediately by multiple incisions through the fascia with evacuation of the hematoma. The cruciate and transverse ligaments may act as constricting bands in subfascial swelling and may have to be sectioned if the circulatory block is persistent. Delayed or inadequate treatment may result in severe cases in the so-called "congealed" foot or in actual necrosis of the toes or soft tissues of the dorsal forefoot, with prolonged and permanent disability. CHESTER C. GUY, M.D.

Vener, H. I., and Bower, A. G.: Clinical Tetanus; Treatment in 100 Consecutive Cases with a Net Mortality Rate of 19 Per Cent. *J. Am. M. Ass.*, 1941, 116: 1627.

By treating 100 consecutive patients with tetanus in an identical manner the authors were able to reduce the gross mortality rate prevalent in past years by 27.5 per cent. If the patients dying during the first twenty-four hours of hospitalization are excluded, the series presents a net mortality rate of 19.3 per cent among 88 patients. No material alteration in the mortality rate was obtained among the 25 females, their rate remaining approximately 50 per cent, in contrast to 21.3 per cent among the 75 males. The best results were obtained among children between the ages of ten and fourteen years, but the general mortality rate of 50 per cent was not materially affected in patients under the age of four years or over the age of forty.

A patient with an incubation period of six days or longer under the described method of management has a 75 to 80 per cent chance of recovery, in contrast to the 50 per cent chance of those patients having a shorter incubation period.

Active therapy consists of (1) preliminary procedures; (2) sedation of adequate nature; (3) local treatment of the wound; (4) antitoxin therapy: (a) locally 20,000 units, (b) intramuscularly 60,000 units, (c) cisternally 20,000 units, (d) intravenously 40,000 units in physiological solution of sodium chloride; the dose is repeated in three hours with 20,000 units if no reaction has ensued, and (e) the intramuscular injection of 40,000 units proximal to the previous site of injection, to make a total dose of 200,000 units given within a period of from thirty to thirty-six hours after hospitalization: and (5) methenamine (15 gr.) given intravenously two hours after the first intravenous dose of 40,000 units of serum and from ten to twelve hours after each of the large intramuscular doses of antitoxin.

Serum sickness developed in approximately 39 per cent of the patients. Within the past year, however, new serums have produced relatively little serum reaction or sickness. Serum reactions occur less frequently if the antitoxin is kept at room temperature for twenty-four hours prior to its use and warmed in a lukewarm water bath for from twenty to thirty minutes immediately before use. The ordinary prophylactic dose of 1,500 units of antitoxin is given subcutaneously at four- or five-day intervals for 4 doses, to keep the patient desensitized. If the possibility of future orthopedic or other surgical measures exists these desensitizing doses are continued for a period of two weeks after the surgical intervention. If this precaution is not observed relapses occur.

Next to antitoxin therapy, practical bedside management of the disease and its more common complications, under proper medical and nursing direction, is most important, and preferably nurses skilled in the care of patients with tetanus should be employed. CHARLES BARON, M.D.

Lucchesi, P. F., and Gildersleeve, N.: Anthrax. *J. Am. M. Ass.*, 1941, 116: 1506.

The fatality rate for anthrax is still high, being more than 16 per cent for the five years between 1934 and 1938; however, it is 6 per cent less than in the preceding five-year period because of the earlier diagnosis and the better treatment given to patients. The ideal treatment for anthrax is one which: (1) does not harm the patient, (2) produces the lowest mortality rate, (3) reduces the period of disability, (4) is the least expensive, and (5) is easily given.

Several products used to-day fulfill these ideals; they are (1) anti-anthrax serum, (2) neoarsphenamine, (3) serum plus neoarsphenamine, and (4) sulfanilamide; a few patients have been treated with the last but not in sufficient numbers to allow adequate appraisal.

Forty-eight patients with anthrax were treated as follows: (a) 19 with serum; (b) 10 with neoarsphenamine; (c) 15 with serum and neoarsphenamine;

(d) 3 with sulfanilamide; and (e) 1 with sulfanilamide, serum, and neoarsphenamine.

Neoarsphenamine gave the best results in selected cases. However, if the patient is afflicted with the internal type of anthrax, if the blood stream has been invaded, or if the lesion is on the face or neck, serum is the agent of choice. Serum should be given if there is doubt as to the type of treatment desired.

The dictum "hands off the lesion" should be adhered to strictly. SAMUEL KAHN, M.D.

Koenig, E.: Subcutaneous Phlegmon Due to Diphtheria Bacilli. *Chirurg*, 1940, 12: 581.

Diphtheria of the skin in abscesses and in wounds became known through the epidemics which occurred in various cities following the last war. Guenther and Ehrhardt described a subcutaneous phlegmon in 1907, stating it was clinically characterized by a bluish-red discoloration of the skin; that it showed rapid extension; and was accompanied by high temperatures and the separation of the subcutis from the underlying fascia. The picture was always severe. Koenig presents a single clinical story which differs.

A nurse, while assisting at a tracheotomy in a child with diphtheria was injured by the point of the scalpel through the rubber glove. The wound was at first ignored. Twenty hours later a dry wound about 2 to 3 mm. long was observed on the dorsum of the left hand. The borders were sharp and showed a dry swelling. There was no reddening. Moist dressings were applied and the hand was splinted. On the second day there was a marked increase in swelling associated with severe pain, and the borders of the wound were slightly reddened. A few drops of pus were removed from the wound. The temperature was 38.3° C. The wound was opened widely. There was a very narrow zone of frank infection from which pus exuded, otherwise only a light yellow or light brown edema. Still the swelling involved the entire dorsum of the hand, the extensor surface of the forearm, and a hand's breadth above the elbow. Multiple incisions were made over the involved hand and arm, and edema only was found, but no pus.

Cultures showed generous growths of diphtheria bacilli. A rapid regression of the edema followed. All of the wounds remained dry for one week. Diphtheritic membranes did not develop at any time. At the beginning of the second week, there was considerable drainage of pus and a small amount of pale granulation tissue. The primary point of infection produced considerable pus. Its surrounding area was bluish-red in color and somewhat infiltrated. On the sixteenth day there appeared near the primary injury, an area of necrosis about 1½ by 2 cm. in diameter and likewise a similar area of necrosis appeared on the extensor surface of the middle finger. Healing was slow under Peru balsam and was complete after two months. Ten thousand units of antitoxin had no influence. The function of the middle finger was not significantly disturbed.

This case was unusual in that the course was quite benign; the temperature rose only once to 38.3° C.; otherwise, not over 37.7°. There was an absence of membrane formation and a minimum amount of ulceration. Druegg has already shown with animal experiments that membrane formation and ulceration seldom occur. Accordingly, the membrane formation is not necessary as a criterion of the specific activity of the diphtheria bacillus. That there was a minimum tendency toward ulceration was already known. (FRANZ). RULON W. RAWSON, M.D.

Domagk, G., and Hegler, C.: Chemotherapy of Bacterial Infections (Chemotherapie bakterieller Infektionen). Leipzig: S. Hirzel, 1940.

This little book opens the first of a series of "Beitraegen zur Arzneitherapie." It treats of the sulfonamides and their derivatives predominantly. Following a very worthwhile review of the development of the chemotherapy of bacterial infections, the experimental foundations which were obtained heretofore in the infections with streptococci, staphylococci, gonococci, and pneumococci, as well as with anaerobes, are discussed, as well as the starting point for the clinical testing of the sulfonamides. The previously acquired clinical experiences, with the complete inclusion of the domestic and foreign literature, are then discussed.

The authors admit that a final decision on many aspects of the subject is not possible at the present time. However, from the existing surprising results in erysipelas, pneumonia, meningitis, and gonorrhea, they believe we must conclude that we are on the right track chemotherapeutically. Whoever wishes to work further on this subject along experimental or clinical lines will find this little book of advantage.

(H. FUCHS). LOUIS NEUWELT, M.D.

Mazzeo, M.: On the Anti-Bacterial Effect of the Sulfamide Preparations (Sull'azione antimicrobica dei preparati sulfamidici). *Rassegna internaz. di clin. e terap.*, 1941, 22: 39.

The treatment of streptococcic infections with a colored preparation containing the sulfamide-group sulfamidocrisoidine (prontosil) was introduced in 1932. Since that time other similar preparations were tested, especially a series of non-colored substances, which were supposed to be less toxic (para-aminophenyl-sulfamide or white streptosil).

After a survey of the results obtained with such drugs by other authors in various infectious diseases, Mazzeo mentions the complications which may arise after such treatment: fever, emaciation, phosphaturia, nitrogen crises, affections of the skin, digestive and nervous disturbances, and changes in the blood. Fortunately, statistics have proved that only 1 such result was observed in 100,000 cases treated with the substances in question. Most of the complications, moreover, can be prevented by careful management of the dosage, by regulation of the stools, and by avoidance of the simultaneous administration of other strong drugs. A few patients, however, are hypersensitive even to small doses of sulfamides, perhaps on account of a hereditary disposition. They

are in danger of a lethal agranulocytosis. Therefore, the blood must be examined frequently and certain precautions must be taken.

The author is mainly interested in answering the question: In what particular way do the sulfamides achieve their curative success? Theoretically it is possible that they immediately weaken the bacteria or strengthen the defensive forces of the infected body by stimulating phagocytosis or by increasing the bactericidal forces of the serum. Mazzeo experimented with rabbits, by injecting products of the sulfamide group (prontosil, derganil, pyridin-derganil, and pyridene) into the peritoneum.

In the first series of experiments uninfected animals were treated with sulfamides, and the blood was tested four hours later. The number of leucocytes was increased after equal doses of derganil or derganil-pyridine and after smaller doses of pyridene: the polynuclears were always increased; the lymphocytes were always decreased, and the mononuclears were increased after the administration of derganil and pyridine-derganil. The hemoglobin did not undergo any noteworthy changes.

The second series concerned the phagocytic power of the leucocytes. The blood of rabbits treated with sulfamide was centrifuged; the leucocytes could then be separated. Equal volumes (0.5 c. cm.) of leucocytes, of a suspension containing staphylococci and of physiological solution were mixed *in vitro* at 37°C. A microscopic preparation made after due time showed no increase of the phagocytic power of the leucocytes, unless 0.5 c. cm. of sulfamide was added to the mixture itself.

In the third series the author tested the bactericidal power of the whole blood. After the administration of sulfamides the bactericidal power proved to be remarkably increased against the staphylococcus, but not against the typhoid bacillus.

Determination of the chemotherapeutical property of the sulfamides was the object of the fourth series of experiments. Rabbits which generally died after the injection of 50,000 staphylococci per kgm. of weight were inoculated with 100,000. To some of them sulfamide was administered simultaneously; the others were treated forty hours later. Most of the animals of the first group, but none of the second group, survived.

The author summarizes his results as follows:

The products of the sulfamide group produce a marked leucocytosis; they all stimulate phagocytosis, increase the anti-staphylococcic action of the blood, and are, when injected early, highly effective from a chemotherapeutic point of view.

NELDA CASSUTO.

Hurteau, E. F.: The Intracranial Use of Sulphonamides; Experimental Study of the Histology and Rate of Absorption. *Canadian M. Ass. J.*, 1941, 44: 352.

At a time when sulfonamides have been advocated for use in contaminated wounds, this article is of interest to neurosurgeons particularly, especially those who are dealing with wounds of the brain. A study was undertaken to find out what effect on the normal brain these sulfonamides had when placed in contact with it. The first question to decide was whether these substances destroy brain tissue; and the second question, whether the low degree of solubility of drugs of this group results in encapsulation and indefinite persistence of the drug. Further, an attempt was made to answer the question as to whether the use of the drug would increase the incidence of post-traumatic epilepsy.

Twenty-five cats were operated upon to ascertain the answer to these questions. A cortical excision of from 0.5 to 1 cm. in diameter and of a depth to include part of the white matter and yet not enter the ventricles was made on symmetrical sides of the head. In one side the drug was inserted, and the other wound was left as a control. An attempt was made to be sure that the sides were identical. An average of 100 mgm. of the drug was inserted, and the dura was then closed tightly. The substances were left in from a period of four days to sixty or sixty-eight days, and careful histological studies were made at the end of that time. Extensive tables are provided with the results indicated on them.

At first the drug caused a focal meningeal leucocytic response. Grossly, it could be seen in the tissue as long as twenty days. There was no positive evidence of destruction of nervous tissue, or of glial reaction, in the method used in this study. There was no evidence deduced to show that these drugs increased the extent of scarring in the healing brain. Sulfapyridine was the slowest to be absorbed, but could not be detected after thirty-four days; sulfathiazole could not be detected after seventeen days, and sulfanilamide could not be detected after eleven days.

On the basis of these experiments, it would appear possible to use from 5 to 10 gm. of the powdered form in the human brain. This study shows that there are no contraindications to the use of these sulfonamides in the manner indicated for septic wounds of the human brain.

ADRIEN VERBRUGGHEN, M.D.

Reed, G. B., and Orr, J. H.: Chemotherapy in Experimental Gas Gangrene; Distribution of Drugs from Infected Wounds. *Lancet*, 1941, 240: 376.

Guinea pigs were given experimental gas gangrene by incising the muscles of the thigh and implanting therein devitalized muscle, sterile soil, and cultures of the organism to be tested. The wounds were then closed tightly with catgut. The soil contained calcium salts, which are necessary for the germination of tetanus spores in tissues. This method was thought to most closely simulate naturally developing cases in man.

The four most frequently encountered species of clostridia were used experimentally, namely, welchii, Type A; septique; sordellii; and novyi (oedematiens). The minimal lethal dose of each culture was found

and the average survival times were determined by extensive controls.

Groups of animals infected with clostridia (single-species infection as well as multiple-species infection) were treated with sulfanilamide, sulfapyridine, sulfamethylthiazole, and sulfathiazole. The drugs were administered locally, by mouth alone, and locally and by mouth in combination. (Promin was also used in a small group of animals but was found to be entirely ineffective).

It was found in this series of experiments that all of the sulfonamides used were effective in a large percentage of cases in preventing a fatal infection.

The local use of the drugs proved much more effective than the oral use. Sulfathiazole proved to be the most efficient drug in all species of infection; in fact, it was the only drug that materially influenced clostridium novyi infections. Sulfamethylthiazole was the next most effective drug, while sulfapyridine was superior to the least effective drug,sulfanilamide.

Sulfanilamide resulted in the saving of 25 per cent of the infected animals when administered orally, and 55 per cent were saved when the drug was introduced locally into the wound. The combined local and oral treatment produced a longer survival period, but the number of eventual fatalities was larger than when the drug was used locally alone. In contrast, 87 per cent of the infected animals treated with sulfathiazole recovered when this drug was introduced into the wound. These data show the superiority of sulfathiazole over sulfanilamide, the difference being partly due to the efficiency of sulfathiazole in clostridium novyi infections.

Groups of animals were infected and the sulfonamide introduced into the wounds one, two, three, four, or six hours after the infecting agent had been given. In these groups it was evident that sulfathiazole gave excellent protection up to three or four hours, while sulfanilamide was comparatively ineffective at the end of one hour. The other two drugs gave intermediate protection. After six hours no drugs were of any value locally except in clostridium novyi infections, in which sulfathiazole gave as good results as when introduced at the time of infection.

Sulfonamides given by mouth produce practically the same concentrations in blood and muscle. The authors demonstrated that much higher concentrations of the drugs can be obtained in an extremity by local introduction of the drug. Even when the area directly involved is carefully dissected away to eliminate undissolved drug, the remainder of the extremity shows a concentration many times higher than that which can be obtained by oral administration. Hence, the authors are convinced that the local administration into infected or potentially infected tissue is the most efficient method of giving these drugs. In this connection, these experiments indicate that, although sulfathiazole does not produce as high a concentration in the tissues as sulfanilamide, yet it persists much longer and at the end of twenty-four hours the concentration is much higher than that of sulfanilamide.

The authors do not advocate the replacement of serum treatment and well recognized surgical therapy by chemotherapy in gas gangrene, but they do infer that chemotherapy might possibly retard this infection during the period from the infection of a wound until other treatment can be applied.

LUTHER H. WOLFF, M.D.

Gordon, J., and McLeod, J. W.: The Relative Value of Sulfonamides and Antisera in Experimental Gas Gangrene. *Lancet*, 1941, 240: 407.

The authors compared the relative effectiveness of certain sulfonamides with that of gas-gangrene antisera in the prophylaxis and treatment of experimental gas gangrene. Mice and guinea pigs were used as experimental animals. The species of clostridia used were clostridia welchii, septique, and novyi. The sulfonamides tested were the following: sulfanilamide, sulfapyridine, p-nitrobenzenesulfonamide, M. & B. 693. These drugs were used locally only, as other workers have shown that they are most effective when so used. Dosages of sera and sulfanilamide were used in proportions equivalent to those recommended for use in man. The gas infections were produced by injecting cultures into crushed thigh muscles in guinea pigs, and by subcutaneous injection of cultures in mice.

The experiments indicated that sulfonamides had a very limited protective value in mice. In guinea pigs the sulfonamides apparently had a limited usefulness as a prophylactic agent, but they were much inferior prophylactically to antisera, especially in clostridium novyi infections. For example, sulfanilamide used prophylactically in clostridium welchii infections produced a survival rate of 66.6 per cent, while antitoxin protected 100 per cent. In clostridium novyi infections there were no survivals when sulfonamides were given prophylactically, and here again antisera protected 100 per cent. As a curative agent, sulfonamides were of no value whatsoever, and antisera used in doses ordinarily advocated afforded little curative influence. However, in doses from 200 to 600 times greater than the dose effective in prophylaxis, antisera give fairly good results.

From their experiments, the authors concluded that antisera used prophylactically were far superior to sulfonamides. Very large doses of antisera were necessary in the therapy of gas gangrene, and the authors are of the opinion that antisera should be used prophylactically rather than therapeutically. It is recommended that antisera be administered by multiple injections into the muscles in the vicinity of the wound, since this method proved most effective in the experimental animal.

LUTHER H. WOLFF, M.D.

Delevski, P. S.: Immunotransfusions in Acute Septicemia (Les immunotransfusions dans la septicemie aiguë). *Eksperimental. med.*, 1939, No. 5/6, p. 50.

The author reports on 40 cases of early septicemia and its treatment with immunotransfusions; only

small doses (from 200 to 300 c. cm.) were given each time, i.e., 1 to 8 times. Their effect was judged by the clinical picture and by the changes that showed themselves immunobiologically, for example, in the coagulation mass, by the amount of blood fixation, in the amount of the phagocytes, and in the opsonic index. In all of the author's patients these test figures were low and increased without exception after the transfusion in the patients who recovered; in patients with a fatal outcome these diagnostic figures remained low. According to the author's observation the mortality amounted to 32.5 per cent. This percentage, which is still quite high, is low compared to that of other authors, who report 42, 50, and even 59 per cent.

The author concludes that of all the measures proposed for the treatment of septicemia, the immunotransfusion of blood shows the best results. Even more than with mere replacement of blood, the blood acts as a powerful stimulus upon the blood forming tissue with protective substances. The author also recommends that this immunotransfusion be done as soon as possible.

(Eggert). Louis Neuwelt, M.D.

ANESTHESIA

Allen, J. G., and Livingstone, H.: Postoperative Hypoprothrombinemia and Anesthesia. *Arch. Surg.*, 1941, 42: 522.

The authors state that, in theory, postoperative hypoprothrombinemia may be the result of three factors: (1) loss of prothrombin commensurate with the amount of blood lost, (2) damage to the liver attendant on surgical procedures and anesthesia, and (3) failure to re-establish the body's normal reserves of prothrombin or one of its precursors.

The opinion of most workers is that anesthesia, by producing hepatic injury, could cause a fall in prothrombin: but there are no experimental data to support this theory except cases in which chloroform was used.

Reduction of the prothrombin content of the plasma postoperatively in cases of biliary fistula or obstructive jaundice is frequently seen. That mechanical liver trauma may cause hypoprothrombinemia is demonstrated by massaging the liver at the time of laparotomy.

Failure to establish an adequate prothrombin reserve pre-operatively by means of Vitamin K and bile-salt therapy is also given as a cause of postoperative reduction of prothrombin.

To date, exclusive of chloroform anesthesia, no definite explanation of postoperative hypoprothrombinemia can be given. Vitamin K with bile-salts therapy, given pre-operatively, favorably influences the postoperative condition of the plasma prothrombin—the greater the amount given before operation, the later the appearance of reduction after operation.

The site of storage of vitamin in some form, and of prothrombin or one of its precursors, seemingly is the liver, as removal of that organ in the dog is followed by a sharp reduction of these elements. At present there is no experimental evidence concerning the storage of either Vitamin K or prothrombin.

Some presumptive evidence of the storage of Vitamin K, or prothrombin, in the body is that the longer the period of administration of Vitamin K and bile salts, the longer the prothrombin could be maintained at normal levels after discontinuance of these drugs.

The authors' summary and conclusions follow:

Prothrombin studies were made on 106 patients who underwent surgical procedures exclusive of operations on the biliary tract. Except in 1 case, no change was found in the prothrombin levels following these procedures when ether, vinethene, nitrogen monoxide, ethylene-oxygen, avertin with amylene hydrate, nupercaine, spinal, or local anesthesia was used.

The loss of blood at operation was determined in 11 patients who underwent surgical procedures other than operations on the biliary tract. As much as 785 c.cm. of blood were lost without reduction of the level of plasma prothrombin.

Thirteen patients with obstructive jaundice and 2 patients with bile fistulas received pre-operative Vitamin K therapy for correction of prothrombin deficiency; in all but 2 of these patients, however, a sharp drop in prothrombin occurred during the postoperative period despite the correction of the initial prothrombin deficiency.

The suggestion is made that some form of storage of Vitamin K or prothrombin probably occurs within the body and that the failure to replenish this store in the patient with obstructive jaundice or biliary fistula probably accounts for the postoperative hypoprothrombinemia seen in such patients.

The postoperative hypoprothrombinemia seen in the patient with obstructive jaundice or biliary fistula is the result of inadequate pre-operative Vitamin K and bile-salt therapy and not the result of the usual anesthetic agents employed, exclusive of chloroform. Mathias J. Seifert, M.D.

Phillips, F., Livingstone, H. M., and Adams, W. E.: A Clinical Consideration of Anesthesia in Intrathoracic Operations. *Anes. & Anal.*, 1941, 20: 78.

Major surgery within the thoracic cage is accompanied by many unusual hazards. Pneumonectomy and lobectomy produce sudden changes in the lung volume. Physiological compensation takes place rapidly at the time of ligation of the hilar vessels and bronchi. Prolonged interruption of oxygenation and decarbonization of the blood produces tissue damage. The most frequently observed untoward sequelæ of uncompensated oxygen want are nausea and vomiting, prolonged unconsciousness, intractable headache, renal dysfunction, irreparable liver damage, and impairment of function of the tissue cell.

The problem of adequately maintaining satisfactory surgical anesthesia and unimpaired respira-

tory function demands the skill of a well trained anesthetist who understands respiratory physiology and the specific surgical procedure, and who is able to follow the actual technical progress of the operation in close co-operation with the surgeon in order to foresee approaching crises and adjust the depth of anesthesia and pressure accordingly. At the instant of ligation of the bronchial stump and hilar vessels, alteration of the cardiac rhythm and temporary cessation of the respiration may occur, at which time the trained anesthetist can readily adjust the anesthesia to compensate for this interruption in normal cardiorespiratory function.

Proper respect for intrabronchial pressures during anesthesia is important, since high intrabronchial pressures may lead to vagal shock and result in apnea, rupture of the alveoli or lung parenchyma, spontaneous pneumothorax, or mediastinal emphysema. Maintenance of physiologically optimal intrabronchial pressures automatically minimizes laryngeal stridor and various other complications.

The choice of anesthetic for intrathoracic operations depends on the individual need in each specific case. At all times irritation of the endobronchial mucosa by chemical or mechanical agents, such as ether administered through an endotracheal catheter, is to be avoided. The authors teach that an ideal anesthetic must meet the following requirements:

1. The agent should be (a) non-irritating, (b) nontoxic, (c) permit sufficient oxygen saturation of the blood, (d) allow rapid recovery, (e) permit a rapid return of cough reflex, and (f) produce surgical anesthesia.

2. The method should (a) facilitate good exposure, (b) necessitate only minimal motion of the lungs with the least interference of the cardiorespiratory function, and (c) minimize postoperative complications.

In the clinic 92.1 per cent of the intrathoracic surgery has been performed under general anesthesia with the use of the mask as the method of choice and with minimal, but adequate pressure from apparatus permitting a low positive pressure through the mask. Endotracheal anesthesia has always been available for immediate use when necessary. More recently, bronchoscopy has been employed at the end of operations to facilitate more thorough removal of secretions under direct vision, and thereby avoid the irritation and trauma of a retention endotracheal catheter.

Ethylene-oxygen anesthesia is employed whenever possible because it meets the previously stated requirements and produces few complications following its correct administration. It was used in 54.9 per cent of this series of 102 intrathoracic operations. In 23.5 per cent of the cases, ether supplemented the ethylene-oxygen mixture to provide more relaxation. In a few cases in which cauterization became necessary, a change to a non-explosive agent, nitrous oxide-oxygen, was made during the operation. Most of the extrapleural pneumonolysis cases received nitrous oxide-oxygen alone because of the use of the cautery; this was supplemented by the use of procaine on the pleural dissecting sponges to minimize the stimulation.

In 4 patients avertin was used as a basal anesthetic and supplemented with nitrous oxide-oxygen. Local anesthesia was used in 8 patients since the patients' conditions made inhalation anesthesia undesirable because of markedly impaired cardiorespiratory efficiency. Barbiturates were given routinely by mouth the night before, and again by rectum about one hour preceding the operation. If cough was severe, codeine and occasionally morphine were given hypodermically. Atropine has been discontinued because of the possibility of postoperative atelectasis and tachycardiac complications. A wide variety of intrathoracic operations is presented with a description of the anesthetic agents used and the type of operation performed. The complications, deaths, and end-results are fully discussed.

JOHN E. KIRKPATRICK, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Clark, K. C., Cordiner, G. R. M., and Ellman, P.: Experiments in X-Ray Screen Photography with Control Direct Roentgenographs. *Brit. J. Radiol.*, 1941, 14: 54.

The development of roentgen-ray screen photography is reviewed briefly, and attention is called to the field of usefulness and limitations of this method of examination. In order to ascertain whether conclusions based on it can compare favorably with those obtained by the ordinary roentgen examination, the authors made comparative studies of both normal and diseased individuals. They stress the fact that a technically satisfactory miniature is no less important than a similar full-sized direct roentgenogram for correct interpretation. By collaboration they decided upon a suitable type of negative to meet the requirements for correct interpretation, and developed a technique by which it could be produced. This is described in detail.

In studying the cases examined, the procedure adopted was to make a diagnosis from a projected miniature, and to indicate those cases in which a direct roentgenographic examination was, in their view, advisable. The full-sized negative of each case was then examined and the findings compared with those of the miniature examination. The findings in 80 cases subjected to this procedure are tabulated.

The findings of the 2 examinations were identical in all but 8 of the cases. In only 1 of these 8 cases, the direct examination revealed a lesion, unsuspected at the miniature investigation. In 4 of the cases, the full-sized negative disproved the presence of a lesion suspected on the miniature, but in 2 of the subjects, these were regarded as being probably normal at the miniature examination. In the 3 remaining cases, a suspected Assmann focus was confirmed on the full-sized negative, the presence of an active lesion was disproved, and the exact nature of an unidentified lesion was revealed by the direct method.

In this study, the importance of the use of the method in mass surveys for the detection of early pulmonary lesions in asymptomatic subjects, and its possible extension to the sphere of cardiology, is indicated. ADOLPH HARTUNG, M.D.

Gillan, R. U.: The Experimental Roentgenography of Small Fragments of Glass in Relation to the Human Eye. *Brit. J. Ophth.*, 1941, 25: 117.

The present war-time conditions which so often result in injury of the eye by glass particles have induced the author to carry out a series of experiments on the roentgen visibility of glass foreign bodies, especially since the prevailing opinion seems to be that only the glass containing lead is radiopaque and not the other kinds.

Fourteen specimens were chosen from glasses most commonly in use, namely various window glasses, spectacle glass, glass used in motor car windscreens, and bottle glass. They are tabulated as follows:

Group A	1 24 oz. clear
	2 ¼-in. polish plate
	3 ⅛-in. rough roll
Group B	4 Crown spectacle glass
	5 Crookes glass A.2
	6 London smoke glass
	7 Salvoc safety glass
	8 Welders blue
Group C	9 Toughened safety glass (Triplex)
	10 Laminated safety glass (Triplex)
	11 Armour plate glass (Pilkington)
Group D	12 Green bottle glass
	13 Brown bottle glass
	14 White bottle glass

A piece of each of the specimen glasses was taken in turn, shattered between two layers of gauze by a wooden mallet, and 3 fragments were carefully selected, measuring as nearly as possible in thickness, 2 mm. 1 mm. and ½ mm., respectively. These fragments were placed at equal distances on a small square of dental wax and first fixed against the closed eyelids by means of a bandage. Roentgenograms were made in this position with the subject's head facing downward, the central ray passing above the occiput. Then the wax was placed sagittally, in such a way that the 3 fragments were in close apposition to the inner aspect of the open eye. Additional roentgenograms were made on dental films, which were positioned on the nasal side, the central ray being directed from the temporal side so as to obtain a bone-free image of the eye.

The result of the experiments was the discovery that the fragments of all glass specimens cast roentgen shadows, both on the posterior-anterior and on the lateral films. The 2 mm. pieces showed most clearly, whereas the ¼ mm. pieces were at times rather difficult of detection in the posterior-anterior exposures.

The conclusion was reached that most kinds of glass in common use are radiopaque and that their detection by exacting roentgen examination may be expected. T. LEUCUTIA, M.D.

Master, A. M.: Roentgenoscopy as a Diagnostic Aid in Coronary Occlusion. A Study of 164 Cases. *Am. J. Roentgenol.*, 1941, 45: 350.

The author states that roentgenoscopy is a simple, inexpensive, and reliable means of diagnosing coronary occlusion, and should form part of the exami-

nation of every suspected case. This article is based upon a study of 300 patients of whom 164 had suffered an occlusion and the remaining 136, who had various other lesions, were used as controls. The technique used is described in detail. Normal movements and types of abnormal pulsation are discussed and illustrated diagrammatically.

In 70 of the 164 cases of coronary occlusion, complete or partial systolic expansion or reversal of pulsation was observed and in 39 diminution or absence of pulsation. Thus, ventricular contraction was abnormal in 67 per cent of the series. Reversal of pulsation, which probably occurs in more than half of the cases, is far more characteristic of myocardial infarction than either absence or diminution of pulsation. The findings in the control cases are also given consideration. An attempt made to correlate the location of the lesion as determined by electrocardiography with the pulsation changes observed fluoroscopically failed to show any constant relationship. The incidence of abnormal pulsation in coronary occlusion was found to be greater when the heart was enlarged. When the area of abnormal pulsation was large, the prognosis was poor. Systolic expansion may appear directly after the coronary occlusion and persist for many years. Its disappearance, or a change to absence or diminution of pulsation is of favorable significance.

In his summary the author states that systolic expansion (reversal of pulsation) of the left ventricle, observed in 50 per cent of these cases, is characteristic, if not pathognomonic of myocardial infarction. "Lag" and "doubling" of pulsation are incomplete forms of systolic expansion. Systolic expansion is seen in practically every case of large heart with ventricular aneurysm. Absence and diminution of pulsation were present in 25 per cent of the cases with coronary occlusion, but also occurred in other types of heart disease.

ADOLPH HARTUNG, M.D.

McCullough, J. A. L., and Sutherland, C. G.: Intra-Abdominal Calcification; the Interpretation of Its Roentgenological Manifestations. *Radiology*, 1941, 36: 450.

Deposits of calcium in various tissues of the abdomen are frequently noted as incidental findings in the course of roentgen examinations. Some of them appear in sufficiently characteristic shapes and positions to leave little doubt as to their origin, whereas the interpretation of others may tax the ingenuity of the trained radiologist. Their evaluation may be of the utmost importance and provide the clue to the diagnosis. They must be differentiated from certain simulants and artefacts which are sometimes found and which may be confusing.

Pathological calcification may occur in any mesenchymatous tissue of low metabolism or decreased blood supply, or following the fibrosis of trauma or infection. Similarly, the calcification of tumors is observed when the blood supply is so impaired that degenerative changes have appeared, as is seen in uterine fibroids and in the fibrous walls of cysts and blood vessels.

The abdominal field is analyzed in four fields in regard to the significance of calcifications which may occur in them. In the right upper quadrant deposits in the renal and biliary tracts, pancreatic, adrenal, subdiaphragmatic, and paravertebral areas are given consideration. Their appearance, location, and the special procedures indicated to identify them are discussed in detail.

Certain of the lesions described in connection with the right upper quadrant are not confined to the right alone, but may be found in the left upper quadrant. Apart from these, the most common site of calcium deposit in the left upper quadrant is the spleen. Calcification of the splenic artery may cause some difficulty in interpretation. The vessel may be seen end on and appear as a ring of calcium with a clear center.

In the right lower quadrant the most common type of calcium deposit, apart from those in renal lesions, is that in the mesenteric nodes. Another type of paravertebral calcification is that which occurs following suppurative processes of the lumbar or lower thoracic vertebræ, as in tuberculosis or typhoid spondylitis. Similar findings may occur to the left of the spine. Calcifications in the blood vessels and in the iliolumbar ligaments may also be noted in these regions. Foreign material in the appendix may simulate calcium deposits. Calcified epiploic appendages are also given consideration; they may appear as loose bodies in the pelvis.

Probably the most common type of calcification in the pelvic region is that which occurs in the blood vessel walls or as phleboliths. Urinary concretions, prostatic stones, calcified leiomyomas, and calcification in ovarian cysts, pyosalpinx, seminal vesicles, and ducts are all discussed. Special diagnostic characteristics of dermoids and teratomas are mentioned. Attention is called to the frequent presence of shadows of residue of foreign material, such as bismuth in the gluteal regions.

ADOLPH HARTUNG, M.D.

Golden, R.: Abnormalities of the Small Intestine in Nutritional Disturbances; Some Observations on Their Physiological Basis. *Radiology*, 1941, 36: 262.

In this article the author discusses the disturbances in the physiology and morphology of the small intestines which are associated with abnormal nutritional conditions, and their manifestations on roentgen-ray examination. The literature relating to the subject is reviewed and brief mention is made of the technique of examination. Deficiency states are divided into two broad groups: primary, those arising without obvious anatomical cause; and secondary, those in which the condition is caused by, or at least associated with, disease of the gastrointestinal tract which may interfere with the digestion or absorption of nutriment. Detailed information of the anatomy and physiology of the small

intestine is presented and roentgen manifestations of it are described. Pathological changes produced by deficiency states are discussed in connection with the gross pathology, and pathology of the mucous membrane, submucosa, muscularis, and intramural nervous system. Brief consideration is also given to clinical manifestations.

Roentgenologically, deficiency states affecting the small intestines manifest themselves in the following manner:

1. Variations in intestinal motility in the nature of hypermotility and hypomotility; changes in the intestinal tone resulting in dilatation, particularly in the jejunum; and interceptions of the continuity of the barium column which result in abnormal segmentation.

2. Variations in the normal mucosal pattern in the nature of coarsening and obliteration.

3. Variations in the secreting and absorbing powers of the small intestines, resulting in abnormal flocculation of the barium shadow.

Permanency of the changes noted depends on the severity and duration of the condition; irreversible changes occur if the condition lasts long enough.

The clinical material which served as a basis for this study is reviewed, and 4 case histories are cited in detail, with discussions of them. Included are numerous roentgenograms and photomicrographs which illustrate findings considered more or less characteristic. Possible physiological mechanisms responsible for the findings are discussed, and evidence tending to corroborate them is presented. Interference with, or damage to, the intramural nervous system is considered to be the most likely factor.

In conclusion, the author states that deficiency states might be recognized more readily if adequate importance were attached to findings from properly conducted roentgen studies of the small intestines. Careful roentgen observations and correlation with clinical and pathological evidence in individual cases will assist in advancing knowledge of deficiency states and their differential diagnosis.

ADOLPH HARTUNG, M.D.

Archer, V. W., and Cooper, G., Jr.: Intra-Abdominal Hernia or Intestinal Incarceration; Two Verified Cases Pre-Operatively Diagnosed. *Radiology*, 1941, 36: 458.

The pre-operative diagnosis of intra-abdominal hernia, possible only by roentgenological study, is rare, only 4 cases having been reported according to the authors. They briefly review the literature relating to the condition and give some of the theories advanced as to its causation. However formed, there is an abnormal opening in the region of the duodenojejunal flexure leading into a peritoneal sac which is capable of receiving varying lengths of the small intestine. The opening into the sac may lead, as it usually does, to the left, with the main portion of the sac lying to the left of the midline. In about one-third of the cases, the sac is to the right. The symptomatology in the reported cases has not been consistent.

In this communication, 2 cases, diagnosed preoperatively and confirmed, are added to the literature. In both the sac was on the right side. One case presents the anatomy usually described in the cases previously reported as paraduodenal hernias, except that failure of descent of the cecum was associated with the hernial sac. In the other case, there was no true hernial sac present. The cecum, the ascending colon, and the hepatic flexure were attached by a true mesentery which formed a sac only when this portion of the colon was carried mesially. Details of both cases are included.

In the discussion the authors call attention to the need for short-interval roentgen examinations of the small intestine until all of it has been outlined, when there is a history of discomfort following eating after an interval of an hour or so which is unrelieved by soda, and particularly when it is associated with nausea or vomiting, with no demonstrable lesion in the esophagus, stomach, or duodenum. Matting together of loops with fixation of the coils is of diagnostic importance. The advisability of study in an attack, if possible, is mentioned because incarceration in a false sac may be self-reducible.

ADOLPH HARTUNG, M.D.

Axén, O.: The Value of Arthrography of the Shoulder Joint (Ueber den Wert der Arthrographie des Schultergelenkes). *Acta radiol.*, 1941, 22: 268.

While roentgenography explains possible bone changes, fractures, luxations, and subluxations, it affords no conception regarding the humeroscapular joint itself and particularly not regarding the joint capsule and its conditions. To overcome this difficulty a certain method of examination was tested in 118 men and 55 women since 1938 at the "Serafimerlasarettet" in Stockholm

The technique includes the injection of a contrast medium under roentgenographic control. The patient is put in the dorsal position, with the arm adducted 90 degrees and rotated outward. An injection of aethocaine is made 1 cm. anterior to the acromioclavicular joint, with the needle pointing in the direction of the upper arm, until the point of the needle is against the head of the humerus. The needle, simultaneously with pressure upon the piston, is then withdrawn a few millimeters. If the point of the needle is in the joint, the piston is felt to enter the syringe easily. Without change of the position of the needle, the syringe with aethocaine is replaced by one containing 35 per cent perabrodil, and from 6 to 8 c.cm. of this drug are injected. It is important that the point of the needle be ground transversely so as to prevent the contrast medium from entering the joint and the subacromial bursa simultaneously. After the injection of the contrast medium the shoulder joint is subjected to a few passive motions so as to spread the medium.

The exposures are first made in the dorsal position, some with the arm adducted and rotated inward,

Fig. 1.

Fig. 2.

Fig. 1. Small rupture of the lateral portion of the tendon aponeurosis (x) with a smaller amount of the contrast medium in the subacromial bursa. Also a rupture of the lower part of the joint capsule (xx).

Fig. 2. Arm rotated outward. At x a distinct complete rupture of the anterior lateral part of the aponeurosis, with contrast medium in the subacromial subdeltoid bursa.

Fig. 3.

Fig. 4.

Fig. 3. Rupture of the intra-articular part of the long tendon of the biceps. At x the deformed intertubercular sheath filled with contrast medium.

Fig. 4. Rupture (x) of the lower part of the joint capsule; abundant amounts of the contrast medium in the soft parts below the joint. Also avulsion of the greater tuberosity.

and some with the arm rotated outward about 90 degrees. The ray projection is 25 degrees craniad. An exposure is also made with the arm abducted and rotated outward 90 degrees. The ray projection is 10 degrees caudad. The latter projection is not always possible because of rigidity of the axillary joint. The patient is then examined in the standing position with the fluoroscope to determine the distribution of the contrast medium; in this way it is possible to place the patient in such a position that the area above the joint is projected freely and pathological changes may be demonstrated by different positions of the arm. No complications from this technique were noted. If the contrast material enters the tendon aponeurosis or soft parts, moderate pain is felt. An element of danger, which must be avoided, is the breaking of the needle during the injection. This occurred once.

If there is a break in the continuity of the tendon aponeurosis, so-called supraspinatus rupture, a communication is found between the joint and the subacromial bursa. A break in the continuity between the shoulder joint and this bursa can always be determined indirectly by the passage of the contrast medium into the bursa when the joint is injected.

The ruptures may be classified as follows: (1) incomplete ruptures, which extend slightly from the inner side of the aponeurosis into the tendon (Fig. 1), and (2) complete ruptures, which penetrate the aponeurosis completely and lead to a communication between the joint and the bursa (Fig. 2). With incomplete ruptures the site of rupture itself is roentgenologically demonstrable with very great difficulty; a collection of contrast material is seen only in the tendon aponeurosis and medially inward against the site of the supraspinatus muscle. The complete ruptures show transitions of transversely running tears with ragged edges up to round or rectangular holes with sharp, smooth edges, and also slit-shaped prolongations in the longitudinal direction of the tendon. In the latter types it is impossible to demonstrate the communication itself. If the transverse rupture is large anteroposteriorly, it is considered a total rupture; this is easily demonstrable, a retraction of the rupture edges and a broad communication is always seen.

The clinically important question arises: Does a roentgenographically demonstrable communication between the joint and the subacromial bursa always denote a traumatic injury of the tendon aponeurosis with subsequent clinical symptoms, or can such a communication be present without a known trauma and without clinical symptoms? By examining the normal joints of persons who had sustained injury of one shoulder joint, it was found that in 2 of 17 men, aged from twenty-nine to seventy-three years, a communication between the bursa and the joint was present; while in 11 women, from forty-three to seventy-two years old, who were examined, 4 cases were found. In 1 case the injured shoulder joint showed no change arthrographically, whereas the so-called normal joint showed a communication between the bursa and the joint. In the remaining cases the communication was bilateral.

Arthrography can also give valuable information regarding the condition of the shoulder joint, as in 2 cases of rupture of the intra-articular portion of the long tendon of the biceps (Fig. 3). With anterior luxations in the humeroscapular joint there often are ruptures of the lower capsular recess with escape of the contrast material into the soft parts below the joint (Fig. 4). In a case with habitual luxation of the joint, a residual cavity communicated with this rupture and represented the site of escape of the head of the humerus.

The relationship between a trauma and a demonstrable communication between the joint and the subacromial bursa must be assessed carefully in patients over fifty years of age, as it has been shown

that such may be present without a known trauma and without clinical symptoms. An examination of the so-called normal shoulder joint is of value in such cases, as a communication present on this side between the joint and subacromial bursa indicates that the tendon aponeurosis was the bilateral seat of changes even before trauma. LOUIS NEUWELT, M.D.

Widmann, B. P.: Radiation Therapy in Cancer of the Skin. *Am. J. Roentgenol.*, 1941, 45: 382.

A procedure for treating cancer of the skin with low voltage (75 to 135 kv.) roentgen rays or radium which the author believes is simple, speedy, effective, and economical is presented. Attention is called to the wide variations of technique reported by different authors, and the expediency of establishing a predetermined dose that will allow for differences of sensitivity or resistance is stressed. The various factors entering into dosage considerations are discussed at length and numerous authors are quoted to indicate the existing variations in what is considered a skin erythema dose.

In the author's technique total doses are recorded as roentgens. The skin erythema dose is arbitrarily considered as equivalent to 500 roentgens. This establishes a basic biological skin unit, multiples of which constitute the total dose of roentgens. The skin unit of 500 roentgens is regarded as uniform for all surface areas of a neoplasm of from 0.5 to 20 cm. in diameter, because the commensurate increased infiltration value of the bulk of tumor thickness of large lesions compensates for the actual physical difference. The size of the lesion is considered only as to the approximate bulk or thickness—a shallow lesion is less than 0.5 cm. in elevation about the surrounding normal skin, and a large or fungating lesion is more than 0.5 cm. in elevation.

For shallow lesions three treatments of 1,000 roentgens are given every other day. A liberal margin of surrounding skin is included. A filtration of 1 mm. of aluminum is recommended for the second and third treatments. If within from two to six weeks there is definite, or a suspicion of, residual disease then additional treatment with 1,000 roentgens is given and sharply localized to the actual or suspected residual thickening. The reactions resulting from these doses are described. The need for variations in the technique are also mentioned.

For large or fungating lesions, three treatments of 1,500 roentgens are given, one every other day. Additional sharply localized doses of 1,000 roentgens are given to any suspected residual disease that may appear within from two to six weeks or to the entire original area of involvement if necessary. The rationale of both plans is discussed and possible developments requiring modifications or additions for obtaining desired results are mentioned.

Radium technique for shallow and small lesions involves the administration of the full dose of 5 skin erythema doses at one sitting. If the lesion is infiltrating, a procedure similar to that used for large fungating lesions with roentgen rays is utilized.

A routine experience of ten years at the Philadelphia General Hospital has demonstrated an almost uniform applicability of the technique to all sizes and cellular types of lesions and that it provides a fundamental and concrete working basis from which changes may evolve to meet the exigencies of particular problems. ADOLPH HARTUNG, M.D.

Koskvee, L.: Roentgen-Ray Treatment of Actinomycosis (Roentgenbehandlung der Aktinomykose). *Eesti Arst.*, 1940, 19: 189.

The author reports on 150 cases of actinomycosis which he treated with roentgen irradiation, omitting surgical intervention and potassium-iodide therapy. Surgical operation (deep incision and scraping) as well as the internal administration of potassium iodide are ineffective or impair the result of roentgen irradiation. Seventy per cent of the patients treated were cured with from one to three series of irradiation, while the remainder required from four to seven series. Of 120 cervicofacial cases 97 were cured, 10 ended fatally, 5 were still under treatment, and 8 were unreported. Of 17 abdominal cases 9 were cured and 6 ended fatally. Of a group of 11 patients with thoraco-abdominal actinomycosis, only 3 were cured and 8 died.

The use of weaker doses of x-rays showed good results in the cases in which treatment was given in the early stages. In order to reduce the mortality rate from actinomycosis, all patients must receive roentgen-ray treatment without delay which implies an early diagnosis. (W. PLATH). HILDA H. WHEELER.

Ebenius, B.: Peroral Roentgen Treatment of Malignant Tumors. *Acta radiol.*, 1941, 22: 194.

Malignant tumors of the oral cavity and throat suitable for roentgen therapy are, as a rule, irradiated externally through the skin and other tissues with the use of a number of fields of entrance. This implies that large parts of the oral cavity and throat become irradiated, which causes considerable discomfort to the patient, particularly in the reactive stage. The simultaneously arising extensive epithelitis also has a detrimental effect on the general health by hampering nutrition, and bronchopneumonia may sometimes develop. With larger tumors these disadvantages cannot be avoided. In the case of smaller tumors, however, it is sometimes possible by the local application of radium or by combination with a surgical procedure to avail oneself of a therapy more gentle toward the surrounding normal tissues.

Recently, however, another method of treatment suitable for relatively small tumors has found increased application, namely roentgen irradiation through a perorally inserted cylinder of metal or other appropriate material. This method of procedure makes possible roentgenological treatment of a limited area with protection of the surroundings from undesired irradiation, which fulfills the prerequisites for a form of therapy as gentle as possible for the patient. The method is in no way new as it was first described in 1903 by Brickner;

but it did not become popular, probably due to purely technical difficulties.

Since 1936 peroral roentgen treatment has again begun to be used at the Radiumhemmet and the author constructed for this purpose a device which has now been tested out for about five years and has shown itself suitable. The problem of fixation has been solved as follows: After the end of the peroral cylinder has been remodelled with the help of a scissors or knife so that it is adapted to the area to be treated, a suitable amount of warmed dental compound is fastened on the places corresponding to the site of the teeth and alveolar protuberances. While the compound is still soft, the cylinder is placed in the desired position and when the patient then bites, an impression is obtained of the teeth or jaws. A last adjustment is made before the mass has completely hardened. The cylinder is then ready for use.

Since 1936 about 70 patients have been treated at the Radiumhemmet in accordance with this method. The material consisted of cases with tumors inside of the cheeks, on the alveolar ridges, on the hard and soft palate, in the sublingual region, on the tongue, in the tonsillar region, and in the mesopharynx and nasopharynx.

The indications for peroral roentgen treatment are as follows: The tumor should be so situated that the peroral cylinder can be directly applied to it (the nasopharyngeal tumors are, of course, an exception). Also, tumors of the base of the tongue and the lower part of the mesopharynx are therefore not accessible to this form of therapy. Among tumors of the oral cavity, those of the tongue are the least suitable for peroral treatment because of the mobility of the tongue and the fixation difficulties associated with this feature. The size of the tumor is also decisive as to the applicability of the method. As cylinders of greater diameter than from 4.5 to 5 cm. usually cannot be introduced perorally, the upper limit for the size of the tumor may be set at a diameter of from 3 to 3.5 cm. The tumor should be well demarcated, otherwise there is a chance that some portion will not be irradiated. The width of the mouth and mobility of the jaw articulations are also significant factors. In doubtful cases it is preferable to select some other irradiation technique than the peroral.

Even if peroral roentgen treatment has a relatively limited field of applicability, it is nevertheless, if rightly managed, a particularly valuable method which deserves greater application than it now seems to have. JOSEPH K. NARAT, M.D.

Schenck, S. G.: The Management of Cancer of the Breast with Pre-Operative and Postoperative Irradiation. *Radiology*, 1941, 36: 315.

The statistics of the incidence and mortality rate of carcinoma of the breast are briefly considered. The clinical and microscopic grading of carcinoma of the breast is also discussed.

Immediately after clinical diagnosis of carcinoma of the breast, and before the report of the biopsy is received, Schenck administers a course of roentgen therapy. The entire breast is cross-fired through two tangential ports in such a manner that the underlying lung is avoided. Two hundred roentgens are given daily to each portal until a total of from 2,000 to 2,600 roentgens is reached. The factors used are 200 kv., 50 cm. distance, 2 mm. of copper and 1 mm. of aluminum for filters. The axilla is cross-fired through anterior and posterior ports or is treated directly through one field. From 1,200 to 1,800 roentgens are given to each port if two are used and from 1,200 to 1,400 are given into the axilla if a single port is used. The daily dose is 200. The technical factors are unchanged. Finally the same technical factors are used and 200 roentgens are given daily until a total of from 1,600 to 2,000 roentgens have been administered to the supraclavicular fossa. The erythema which appears shortly after and sometimes before completion of treatment to each port goes on to blistering and sometimes to almost complete denudation of the epidermis. The roentgen treatment is completed in from twenty-seven to thirty-three days. About eight weeks after the last treatment the patient is subjected to a radical mastectomy.

In 33 per cent of 200 cases of breast carcinoma which were subjected to pre-operative irradiation, Adair reported total destruction of the primary tumor and in 22 per cent of the axillary extension. The author has never seen the tumor mass increase in size during therapy. The results of pre-operative irradiation have been most gratifying in patients in Stage 2. Irradiation has increased the percentage of five-year cures to 57; with operation alone, only 28 per cent of the patients have survived five years without evidence of the disease.

From four to six weeks after operation, a series of postoperative treatments is given. This course is similar to the pre-operative treatments, except that the dosage is kept within the lower limits. The anterior chest wall is treated by tangential rays, and the entire scar is included within the field of irradiation. If for any reason pre-operative irradiation was omitted, postoperative therapy is given about two weeks after surgery. It is unnecessary to delay treatment until the wound heals completely. The patient is examined semi-monthly for three or four months, and then at monthly intervals, for the possibility of regional recurrence or metastases. In addition, Schenck has recommended the induction of an artificial menopause by irradiation to all menstruating patients with breast carcinoma. Sterilization is accomplished by giving from 500 to 600 roentgens to two anterior or lower abdominal ports and two posterior or sacral ports. The factors are 200 kv., 50 cm. distance, and 0.5 mm. of copper and 1 mm. of aluminum for filters.

The technique outlined is adaptable in Stages 1 and 2 of breast carcinoma. Patients in clinical Stage 3 are chiefly a radiological problem. Pre-operative radiation adapted to the individual is followed by conservative surgery or radium therapy. Further

roentgen therapy may be given for the relief of pain and discomfort. Recurrent or clinical Stage 4 cancer is treated with x-rays, radium, or both.

HAROLD C. OCHSNER, M.D.

Strandquist, M.: Transthoracic Roentgen Treatment of Cancer of the Esophagus. *Acta radiol.*, 1941, 22: 172.

The author gives a detailed account of 36 patients treated with roentgen irradiation for cancer of the thoracic esophagus. He describes a special focusing technique for transthoracic cross-firing, and stresses the importance of a rational tumor dosage. He also describes the accidents and complications of the treatment, and discusses the results in relation to the daily and total tumor dosage.

Although lasting results seem to be very rare, 4 two-year cures and good palliative results are a stimulant to further attempts.

The author concludes by emphasizing the desirability of every clinic's reporting its cases with detailed information as to the daily and total tumor dose, expressed in tissue roentgens and the number of treatment days, in order that experience in regard to the ideal tumor dosage be enlarged.

JOSEPH K. NARAT, M.D.

Walter, R. I., Bachman, A. L., and Harris, W.: The Treatment of Carcinoma of the Ovary. Improvement of Results with Postoperative Radiotherapy. *Am. J. Roentgenol.*, 1941, 45: 403.

The authors' findings and studies of other investigators indicate that postoperative radiotherapy effects a noteworthy improvement in results obtainable in the treatment of carcinoma of the ovary. The authors present a review of the literature and observations on 124 additional cases treated by surgery alone or by surgery plus radiation therapy.

Failure to classify cases according to the stage of progression has made evaluation of the early reports difficult. The material on which this report is based is grouped in this manner. The studies agree with reports of other investigators that surgery alone gives results comparable to surgery plus postoperative irradiation in Stage I. In Stage II, however, postoperative radiotherapy definitely improves the results. The value of postoperative radiation therapy in those cases of ovarian carcinoma in which part of the disease remains following surgery (Stage III) is also tabulated. The increased number of five-year survivals in the irradiated group appears to be of statistical significance. In a combined series of various investigators, 150 cases of Stage IV ovarian carcinoma treated by postoperative radiotherapy showed that 9 patients (6 per cent) had survived five years. This result represents a distinct improvement over that obtained in the non-irradiated group.

The procedures followed in connection with the cases studied are recorded both as to diagnosis and therapy. The results are tabulated according to five-year survivals with surgery alone, with operation plus inadequate roentgen therapy, with operation plus indeterminate irradiation, and with surgery plus adequate roentgen therapy. The prognostic value of morphological classification and histological grading of malignancy was also investigated. Conclusions reached from these comparative studies are presented and discussed.

Surgery alone has been repeatedly shown to be most effective in the localized, unilateral cases. The value of postoperative radiotherapy is apparent in all reported series. Its relative importance and effectiveness increases proportionately with the stage of progression of the neoplasm. To be effective radiotherapy must be given in adequate amounts. Stage IV cases which offer a poor prognosis under any form of treatment should, whenever feasible, be given the benefits of maximum dosage. If operation is considered in these cases pre-operative irradiation is advocated. ADOLPH HARTUNG, M.D.

Holmes, B. E.: Serum Cholesterol and Irradiation Sickness. *Brit. M. J.*, 1941, 1: 314.

The occurrence of sickness and other unfavorable reactions after roentgen therapy is no longer a major problem but the author believed that the volume of literature on the subject of changes in serum cholesterol values justified further investigation. A number of authors, particularly Burgheim, observed in some cases a sharp fall in the serum cholesterol after x-ray treatment, which was followed by vomiting. No fall in the serum cholesterol had been reported in patients not suffering from unfavorable symptoms. Burgheim had also obtained good results by giving cholesterol as a preventive of x-ray sickness.

The investigations of the author involved daily irradiation of a series of cases for a given period and collection of blood samples before and after the first two irradiations of such a series. It was found that the most usual reaction to the first, and often to the second, irradiation was a considerable rise in the serum cholesterol. Such a rise did not appear in 4 cases in which vomiting occurred, but there was a considerable fall. There was not necessarily a direct relationship between the fall of the serum-cholesterol value and the onset of symptoms. In 1 case the fall in serum cholesterol did not occur until after the second irradiation, whereas vomiting began after the first irradiation; in another instance there was vomiting nearly twenty-four hours after the first irradiation, when the serum-cholesterol value had returned to normal.

It is concluded that there may be a tendency to lowering of the serum-cholesterol value in patients liable to x-ray sickness. Any direct relationship between the amount of cholesterol in the serum and the symptoms observed, or any definite time relationship between the two cannot be substantiated. It is believed that some factor concerned with the production of the symptoms may also tend to produce a change in the metabolism which leads to a loss of cholesterol from the blood.

HAROLD C. OCHSNER, M.D

RADIUM

Kjellberg, S. R.: Radiological Treatment of Epulis (Radiologische Behandlung von Epuliden). *Acta radiol.*, 1941, 22: 202.

Kjellberg surveys 109 cases of epulis treated radiologically in the Radiumhemmet in Stockholm, Sweden, in the period from 1922 to 1938. In accordance with the findings of other investigators, he found a slight prevalence of the lower jaw as a tumor site, that the ages of the patients ranged from twenty to forty years, and that the ratio of females to males was 2.4 to 1. In all of the cases there was clinical and histological benignity, but a tendency toward local recurrence. Histologically, the fibromatous, angiomatous, mesenchymal tumors without giant cells were differentiated from mesenchymal tumors with giant cells. Two cases could not be classified in any of the above groups, as there were adamantinoma-like pictures in one, and plasmocytosarcoma-like structures in the other. Both, however, responded well to the treatment. The etiology of epulis is not established. Kjellberg is inclined to believe in the theory that infection is the main cause.

Except for 4 cases which were treated with roentgen rays (1,500 roentgens in 5 doses of 300 roentgens each through 0.5 mm. of copper and 1 mm. of aluminum, with 170 kv.), Kjellberg's patients were treated with radium. Radium treatment consisted either of teleradiotherapy, with a distance of 6 cm. from the radium (3 or 5 gm. of radium element in the form of radium sulfate given through a filter equivalent to 6 mm. of lead) to the skin. Usually a skin dose of from 2,700 to 3,600 roentgens was given. This treatment was followed by a second shorter teleradium treatment or by an application at close range if the first treatment was not fully successful. Brachyradiotherapy was carried out by implanting needles containing about 10 mgm. of radium element in one or several rows with a distance of 5 mm. between each two needles, and a filter corresponding to 0.5 mm. of lead. From one to seven needles were used, according to the size of the tumor. The duration of a treatment was from two to four hours. Superficial application was done by means of either the same needles or tubes containing 10 mgm. of radium element with a filter corresponding to 0.6 mm. of lead, or with a combination of tubes and needles. They were mounted in a dental plastic compound mass. A distance of 1 or 2, even occasionally 5 mm., was maintained between the tumor surface and the radium carrier. Usually, the tumor was removed after the insertion of radium to its base.

Histological studies showed that the vascular tumors were more radiosensitive than the rest. They disappeared within two months, while the other types did not disappear before one half or even a whole year. Occasionally, there was an incipient enlargement for two or three weeks after the radium treatment, followed by shrinkage and disappearance. Surgical removal after radium treatment led to quicker healing than the radium treatment alone.

Of the 109 patients treated, 59 showed a five-year cure, 21 have been symptom-free for from three to five years, and 19 for from one to three years; but these were all recent cases. Four of the remaining patients were operated upon very recently, 2 are dead, 2 are lost, and 1 cannot have further treatment for external reasons. In 9 patients there was a recurrence after the radium treatment. Thirty-one of the patients had undergone surgical treatment for epulis before they received radium therapy, and 13 of these had recurrences also after a second operation; 5 after a third, and one even after a fourth operation. Six of these 31 patients had recurrences also following radium treatment.

HEINRICH LAMM, M.D.

Schmitz, H. E., and Sheehan, J. F.: Five-Year End-Results in Cervical Carcinoma Treated with Radium and 800 Kilovolt Roentgen Rays. *Am. J. Roentgenol.*, 1941, 45: 229.

Since May, 1933, supervoltage roentgen therapy was used at the Mercy Hospital Institute of Radiation Therapy of Chicago, first with 500 kv. and later with 800 kv.

The technical factors, briefly, were: 800 kv. maximum obtained from a double pulsating Villard circuit of 10 ma., a roentgen tube continuously evacuated by oil pumps, water-cooled tungsten target, 10 mm. of copper-equivalent filter, 70 cm. of focal skin distance, and ½ value layer of 8.2 mm. of copper corresponding to an average wave length of 0.0128 Angstrom unit. The output of the tube was 36 roentgen/min without backscatter and 44 roentgen/min with backscatter, and the depth dose at 10 cm. amounted to 54.5 per cent if the field was from 300 to 400 sq. cm. The amount of radiation required to produce a tolerant skin dose with 800 kv. was 4,000 roentgens if applied in 10 fractions at 48-hour intervals.

In treating carcinoma of the cervix uteri, two portals of entry were used for the purpose of cross-firing if the anteroposterior diameter of the pelvis was 24 cm. or less, and three or more portals if the diameter was greater than 25 cm. The mid-pelvic dose attained about 4,000 roentgens. In addition to this, 4,500 mgm. hours of radium were administered in 3 doses of 1,500 mgm. hours each, given at weekly intervals.

Following such treatment, the local reactions of the skin and mucous membranes, as well as the changes in the blood, were examined, and by running serial sections the microscopic changes of the tumor and the changes in the fibromuscular coat of the cervix were studied.

The changes noted in the carcinomas included: (1) swelling of the cytoplasm and nuclei of the tumor cells; (2) loss of regularity in the pattern of the tumor; (3) increasing cornification; (4) relative increase in abnormal mytoses and increase in the number of cell monsters; (5) obliteration of the boundaries of cells; (6) bizarre nuclear forms; (7) caryolysis; (8) pycnosis; (9) neutrophilic infiltration in

partially or completely cornified masses of cells; (10) foreign-body giant cells; (11) fine and coarse vacuolation of the tumor cells; (12) decrease in the size of sheets of tumor, with relative increase in the amount of stroma.

The changes in the fibromuscular coat of the cervix included: (1) surface ulceration with necrosis and neutrophilic infiltration; (2) a zone of edema beneath this layer; (3) swelling of the collagen and ultimate hyalinization; (4) necrosis of the capillary endothelium and the walls of the arterioles, with thrombosis; (5) swelling of collagen and hyalinization in the subendothelial tissues of the walls of the small arteries; (6) atrophy of smooth muscle.

Generally, it was found that whereas the aforesaid type of radiation has, with the doses given, a lethal effect on the cancer cells, the effect on the normal structures is such that a recovery *ad integrum* follows within about four to six months.

In 26 cases of primary carcinoma of the cervix which were treated during the years of 1933 and 1934, the five-year survival ratio was as follows:

TABLE I.—SURVIVAL RATE

Clinical group.....	I	II	III	IV	Total
No. of cases	2	1	9	14	26
No. of patients well for five years....	2	1	7	2	12 (46.1 per cent)

Although the total number of cases is small, a comparison with a similar group of cases treated by previous methods shows that a pronounced increase in the survivals was obtained with a combination of 800 kv. external irradiation and intracavitary radium.

Nine photomicrographs are reproduced in the text showing the effect of the radiation on cervical cancer tissues. T. LEUCUTIA, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Barker, W. H.: The Uses and Abuses of the Sulfonamide Drugs. *Med. Clin. North Am.*, 1941, 25: 453.

The important work of Domagk reported less than six years ago marks the starting-point of the synthesis and clinical application of the sulfonamide group of drugs. Among the important compounds developed since the introduction of the red dye prontosil are sulfanilamide, neoprontosil, sulfapyridine, sulfathiazole, and most recently, sulfanilylguanidine.

Sulfanilamide is still the drug of choice for the treatment of infections due to the beta hemolytic streptococcus, meningococcus, Ducrey bacillus, and Welch bacillus. Its value is also well established in certain infections of the urinary tract, and in trachoma and lymphogranuloma inguinale.

Familiarity with facts regarding the absorption and excretion of the drug is necessary for effective administration. Experimental and clinical observations by Long, Marshall, *et al.*, have demonstrated that the peak blood level of sulfanilamide is reached in four hours after the first single dose. They contend, therefore, that the drug should be given in divided doses at four-hour intervals both day and night in order to maintain the desired blood concentration.

In severe infections, a large initial dose of sulfanilamide is recommended in order that the desired level of 10 mgm. per cent may be attained as quickly as possible. Recurrences of infection will be rare if sulfanilamide is not discontinued at once, but decreased slowly day by day until the patient has definitely recovered from the infection. In milder tissue infections, blood levels of sulfanilamide of from 5 to 10 mgm. per cent are generally adequate.

Sulfanilamide can be given parenterally if the patient cannot tolerate the tablets by mouth or has faulty gastro-intestinal absorption. It is, however, a less satisfactory method of administering the drug and the oral method should be instituted as soon as possible.

It was found that the amount of sulfanilamide per pound of body weight required to establish adequate levels of the drug in the blood of children is considerably greater than that needed in adults. This variation depends on the fluid intake to weight ratio, which is greater in children, especially when fever is present. Experience shows that if large amounts of fluid are given, it is difficult to obtain and maintain effective levels because of the rapid excretion of the sulfanilamide.

Sulfanilamide passes over into the spinal fluid in about the same concentration as in the blood level. Intrathecal therapy is not necessarily indicated in meningeal infections. Sulfanilamide can be found in a similar concentration in transudates and exudates into all of the body cavities, and collections of pus in closed and open cavities. Since recurrences depend on the too early discontinuance of the drug, its administration should be continued for at least ten days after the patient is completely well.

The administration of other drugs during sulfanilamide therapy is not contraindicated, if necessary. Bicarbonate of soda should always be given in doses half as large as or equal to the doses of sulfanilamide, in order to prevent clinical acidosis from developing.

The antidote for sulfanilamide is water given in large amounts rapidly. The toxic manifestations requiring immediate elimination of the drug from the body are: granulocytopenia, acute hemolytic anemia, and hepatitis. It is important to follow the temperature, the hemoglobin level, and the leucocyte count at regular and frequent intervals, in order to recognize the more serious toxic effects in their incipiency.

Sulfapyridine and sulfathiazole have been found to be distinctly superior to sulfanilamide in the treatment of pneumococcal, staphylococcal, and gonococcal infections.

As with sulfanilamide, it is necessary to be familiar with certain special properties of sulfapyridine and sulfathiazole. Unfortunately, sulfapyridine is much less soluble than sulfanilamide, and its absorption may vary from 30 to 80 per cent of the administered dose in two different patients. Conjugation of sulfapyridine in the body to the inactive acetylated form is highly variable in different subjects, so that it is important to determine the level of free sulfapyridine in the blood at frequent intervals. Blood levels of from 4 to 6 mgm. per cent of free sulfapyridine are considered satisfactory for the control of mild to moderately severe pneumococcal infections, whereas about double this level is desirable in more serious infections. It has been found expedient to grind the tablets of sulfapyridine and mix the powder in liquids, applesauce, or jam for children.

A soluble sodium salt of sulfapyridine may be given intravenously in pneumococcic bacteriemia.

During the administration of these drugs, fluids should be forced sufficiently to maintain the twenty-four-hour output of urine between 1,000 and 1,500 c.cm. in an adult patient. This measure helps to prevent the precipitation in the kidneys of crystals of the acetylated form. There is no need to give sodium bicarbonate with these drugs. Other necessary drugs may be administered in conjunction with sulfapyridine or sulfathiazole.

In pneumococcal pneumonia, each drug appears equally efficient. There is a lower incidence of vomiting with sulfathiazole. Before the administration of either drug, the sputum should be obtained for culture and pneumococcus typing, and a blood

culture should be taken. The drug chosen should be administered to all patients with acute lobar pneumonia, bronchopneumonia, or postoperative pneumonia as soon as the clinical diagnosis is established. In severe purulent bronchitis of pneumococcal origin, these drugs are indicated.

A large initial dose of 4 gm. of the drug is advisable for adult patients in order to establish an effective blood level of the drug as soon as possible. Doses of 1 gm. should be given every four hours day and night thereafter, until the temperature has remained normal for seventy-two hours. The drug may be discontinued then entirely. In children, Long recommends 1 gr. per lb. of body weight as an initial dose and ¼ gr. per lb. every six hours as a maintenance dose. This dosage is slightly smaller in infants.

The same general toxic effects, with the additional hazard of severe renal damage, may occur with sulfapyridine and sulfathiazole as with sulfanilamide. The antidote is the same: the forcing of fluids and discontinuing the drug. The supervision of the patient should include careful clinical observations, the temperature, hemoglobin, leucocyte count, urinalysis, and non-protein nitrogen determinations, if the urinary output diminishes.

Since recovery in pneumonia depends on specific antibody formation, type-specific serum should be given to the seriously ill patient, especially if he fails to show clinical improvement within forty-eight hours after the institution of chemotherapy.

At present, a new sulfonamide drug, sulfanilylguanidine, may prove effective in treating infections of the intestinal tract.

Neoprontosil breaks down to release sulfanilamide in the body. Its only advantage appears to be its convenience for parenteral administration.

Among the infectious diseases in which sulfonamide therapy seems questionable are many bacillary infections such as undulant fever, tularemia, infections with the Friedlaender bacillus or bacillus influenzæ; also subacute bacterial endocarditis due to the streptococcus viridans, and fungus infections such as actinomycosis.

There are a few conditions in which successful prophylaxis with sulfonamide drugs may be given, such as inactive rheumatic heart disease, before and after dental extractions, and during scarlet fever and other hemolytic streptococcal epidemics. The immediate administration of sulfanilamide to victims of serious crushing injuries such as compound fractures may prevent the development of dangerous secondary infection, particularly with the hemolytic streptococcus or the Welch bacillus. The administration of sulfathiazole before and after resection of a portion of the bowel may help to cut down the danger of postoperative peritonitis.

The use of sulfonamide drugs in infections in which there is no experimental or clinical evidence that such therapy will be of value, must be regarded as an abuse of the drug in question. Probably the most widespread abuse of the sulfonamide drugs to date has occurred by their administration to victims of the filterable viruses, particularly those of the common cold or influenza. The only exception applies to lymphogranuloma inguinale. There is no excuse for using these drugs in uncomplicated measles, mumps, chicken-pox, poliomyelitis, or encephalitis. It appears that sulfanilamide is harmful in active rheumatic fever. It has no effect on uncomplicated tuberculosis, syphilis, enteric fevers, or dysentery.

In conclusion, sulfonamide drugs should not be employed indiscriminately. It is important to select the most effective drug for the treatment of a given infection. These drugs should be administered only under the direct supervision of a physician because of their toxicity, and patients receiving any of them should, whenever possible, be hospitalized in order to insure careful clinical and laboratory control.

JOHN E. KIRKPATRICK, M.D.

Strauss, E., Lowell, F. C., Taylor, F. H. L., and Finland, M.: Observations on the Absorption, Excretion, and Distribution of Sulfanilamide, Sulfapyridine, Sulfathiazole, and Sulfamethylthiazole. *Ann. Int. Med.*, 1941, 14: 1360.

This article deals with a continuation of studies that have been reported. Human subjects were given, by various routes, a single 5-gm. dose of sulfanilamide, sulfapyridine, sulfathiazole, and sulfamethylthiazole, and the sodium salts of the latter three drugs. In general, the sodium salts given intravenously or orally yielded higher blood levels, and these levels were attained more rapidly than when the corresponding drugs were given by mouth. The highest levels were obtained with sodium sulfathiazole.

Sulfathiazole and its sodium salt were excreted more rapidly into the urine than either sulfanilamide or sulfapyridine. All the drugs, with the exception of sulfamethylthiazole, were excreted more or less quantitatively after intravenous or subcutaneous injection, and almost all of the administered drugs were recovered from the urine after their oral administration. As regards sulfamethylthiazole, only about 60 per cent of the amount administered was recovered from the urine, regardless of the route by which it was given. Sulfathiazole showed the least amount of conjugation and sulfapyridine showed the most. After oral administration of sodium sulfapyridine, the percentage of acetylated drug in the blood and urine was considerably lower than that found after sulfapyridine itself was given by mouth.

Different subjects varied with respect to their absorption, excretion, and conjugation of the different drugs. There were apparently fewer variations with sulfathiazole than with any of the other compounds. Sulfanilamide was fairly well absorbed from the rectum, but all the other drugs were poorly absorbed after rectal administration.

The four compounds were found to distribute themselves differently between the blood plasma and the red blood cells. Sulfanilamide was found in the red blood cells in greater concentration than in the

plasma; sulfapyridine was about equally distributed; sulfathiazole was present in somewhat greater concentrations in the plasma; and sulfamethylthiazole was found mostly in the plasma. Sulfathiazole was cleared from the blood at a rate which was lower than that of either sulfanilamide or sulfapyridine. The clearance rates of these drugs indicated varying degrees of tubular reabsorption which was greatest for sulfamethylthiazole and least for sulfathiazole.

The concentrations of the drugs were higher in the bile and lower in the spinal fluids than in the blood. Sulfathiazole was present regularly in the spinal fluid in about one-third the concentration found in the blood.

Sulfapyridine and sulfathiazole were found in the kidney in considerably higher concentrations than in the blood and other organs. The concentrations of sulfanilamide were about the same in the various organs studied, including the kidney.

The para-acetyl derivatives of sulfanilamide, sulfapyridine, and sulfathiazole were poorly absorbed after oral administration. Only a small percentage of these drugs was de-acetylated.

WALTER H. NADLER, M.D.

Guarnaschelli-Raggio, A.: The Action of Dehydrotachisterin upon Some Electrolytes and upon the β Glycerophosphatasis of the Serum in 1 Case of Idiopathic Tetany (Azione della deidro-tachisterina [A. T. 10 di Holtz] su alcuni elettroliti e sulla glicero-fosfatasi del siero in un caso di tetania idiopatica). *Policlin.*, Rome, 1941, 48: sez. med. 1.

The author attempts to clarify the relations which exist between the new compound, dehydrotachisterin, and the mineral metabolism. The diminution of the quantity of ionized calcium in the blood influences the neuromuscular excitability; calcemia below 7 mgm. per cent causes tetany. Very few therapies were efficient in tetany. Holtz found dehydrotachisterin effective and called it A.T. 10. It is a 0.5 per cent oil solution obtained from ergosterin, tachisterin, Vitamin D_2, and toxisterin from the "calcinosis factor."

Clairmont and many others admit the superiority of A.T. 10 compared to parathormone and to transplantation therapy. It has been used in all the complications of tetany. It has a steady action and produces a regular hypocalcemic curve. The right dose must be established for each patient individually. Disturbances are very rarely observed; Holtz supposes them to be due to hypercalcemia. They are transitory, and Vitamin A and follicular hormones are antidotes.

One case was studied and found to be an idiopathic tetany. Five cubic centimeters of dehydrotachisterin were administered. For seven days determinations of the mineral content of the serum were carried out. Eleven days later 8 c.cm. were given, always per os. The condition of the patient was improved after twenty-four hours. He left the clinic after thirty-one days.

The increase of the potassium/calcium value was due at first to hypopotassemia. The curves after the second administration (8 c.cm.) had the same form as those obtained by plotting the mineral contents after the first treatment with 5 c.cm. After the second treatment the potassium content was less than it was before the treatment (18 mgm. per cent instead of 20 mgm. per cent). After twenty-four hours the potassium content diminished to 6 mgm. per cent and then it started to rise slowly again. The seventh day it reached its normal value and on the ninth day it was above normal.

The glycerophosphatase was low before treatment, it reached a normal value the fourth day, and increased to a maximum value on the sixth day. Calcium increased the fourth day and reached its normal value on the fifth day. A decrease then followed, and on the seventh day a slow increase started again.

The potassium/calcium quotient diminished greatly below the normal value during the first four days and then gradually increased. The magnesium content was influenced very little and the change in the magnesium/calcium quotient was due only to the calcium. The maximum change for the magnesium ranged from 1.78 to 1.22 per cent on the seventh day.

The phosphoremia increased to its maximum on the second day and returned to its initial value on the fifth, with the same values and forms of curves in both treatments (8 c.cm. and 5 c.cm.).

The calcium/phosphorus quotient varied only on account of the calcium. The calcium + magnesium/phosphorus quotient was similar to the calcium/phosphorus quotient. The potassium + phosphorus/calcium + magnesium quotient was similar to the potassium/calcium quotient.

It seems that dehydrotachisterin acts especially upon the potassium and the calcium, influences the sympathetic nervous system, and regulates the mineral metabolism. NELDA CASSUTO.

Ramos, J., and Oria, J.: Symptomatology and Histopathology of the Heart in Patients with Mega-Esophagus and Megacolon (Clínica e histo-patologia do coração em portadores de mega-esôfago e megacolo). *Arq. de cirurg. clín. e exper.*, 1940, 4: 363.

The authors state that, although mega-esophagus and megacolon may be found to appear separately in some patients, they may be associated in others; because of this association, which is not at all rare, it is believed that these two morbid conditions must have a common etiopathogenesis. The disturbances in the passage of substances through the digestive tract are due to an achalasia of the sphincter or sphincters where the disease is localized. These functional disturbances are a consequence of intense and extensive lesions of the myo-enteric plexuses as has been demonstrated by previous histological studies. The etiological element which is capable of causing these lesions is still unknown. Because of the frequent presence of similar lesions in other meta-

sympathetic groups, lesions which recall deficiency diseases, some authors want to include the diseases qualified with the prefix "mega" in the huge group of the incomplete avitaminoses.

The histological lesions characteristic of mega-esophagus and megacolon, localized in the intramural sympathetic plexuses of the esophagus, stomach, colon, and rectum, have already been studied in previous works. In the present work, similar researches in the domain of the cardiac metasympathetic are reported. This study not only showed that the mega syndromes have to be considered as a general disease, the anatomical basis of which would be a neuropathy of the vegetative nervous system, but also confirmed that abnormalities in the electrocardiogram are very frequent in patients with mega-esophagus and megacolon.

The material of the present study consists of 73 cases, including 51 of mega-esophagus, 12 of megacolon, and 10 of association of the two syndromes. In all of these cases, detailed clinical observations, especially concerning the functional and physical disturbances of the heart, and roentgen examinations were made. Electrocardiograms were obtained in 62 cases. In addition to several autopsies made previously, the present work gives the details of the histological examinations of 6 cases, which were made to study the condition of the autonomous nervous system of the heart.

Various interesting observations were made, the most important of which are the following:

1. It was found that the abnormalities of the electrocardiogram in the bearers of the group mega syndromes are really frequent. Generally speaking, they can be divided into two groups: (a) alterations of slight or of no pathological significance: different and isolated alterations of the P wave (15 cases), absence of the T wave in lead III (6 cases), increase in amplitude of T in one or two leads (3 cases), increase in amplitude of T in three leads (1 case), decrease in amplitude of T in one or two leads (7 cases), diphasia of the T wave isolated in lead III (8 cases), negative T wave in lead III (13 cases), extrasystolia demonstrable in the graphic record (4 cases), and paroxystic tachycardia (1 case); and (b) alterations with pathological significance: increase in the P-R space (1 case), increase in amplitude of Q_3 wave (1 case), increased duration of the initial ventricular complex (17 cases), presence of anomalous incisures in the QRS complex (5 cases), alterations in the amplitude of initial ventricular complex accidents, increase being observed in 6 cases and decrease in 21 cases, disturbances of the intraventricular conduction (8 cases), deviation of the electric axis to the left in 12 cases and to the right in 13 cases, slight alterations in the intermediary RS-T segment (4 cases), absence of the T wave in the three leads (3 cases), pronounced decrease in the amplitude of T in the three leads (8 cases), diphasia of the isolated T wave in leads I and II (5 cases), and negative T wave in the three leads or in lead I (2 cases).

The frequency of the abnormalities in the electrocardiogram demonstrates the existence of more or less important disturbances of the heart. These disturbances seem to indicate that the heart really is attacked in these diseases and not only deviated or compressed (mega-esophagus) as was believed of old.

2. In the immense majority of the cases, the physical examination as well as the roentgenological data and, especially, the subjective phenomena (good capacity for work, except during the crises) rarely revealed the presence of any cardiac disturbances which would indicate the existence of the organ's insufficiency. It is interesting to stress this divergence between marked abnormalities in the electrocardiogram and the good condition of the heart. Sometimes even the cardiac discomfort present during the achalasia crises disappeared completely after cure of the process or after cessation of the crisis, even though in some of these cases the electrocardiogram was quite anomalous.

3. The histological study of the heart of 6 patients showed lesions of the chronic type in the intracardiac sympathetic plexus, very similar to the degenerative processes previously observed in the intramural sympathetic plexuses of the esophagus, stomach, colon, and rectum. The basic picture found is the terminal process of an irreparable destruction of the atrial and ventricular, subepicardic and endocardic plexuses, with total fibrosis of the ganglial groups. The interstitial myocarditis, eventually observed, is very discreet and seems to be secondary to the destruction of the plexuses. RICHARD KEMEL, M.D.